THE
ELECTRICAL REVIEW

Volume CXXIX **No. 3335**

Friday, October 24, 1941

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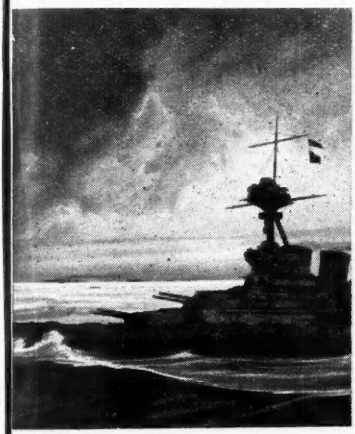
EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1

Telegraphic Address: "Ageekay, Sedist, London." Code: A B C. Telephone No.: Waterloo 3333 (35 lines)
Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage. Entered as Second Class Matter at the New York, U.S.A., Post Office.

Subscription Rates, Postage free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £1 14s. 8d. per annum.

Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW LTD., and crossed "Lloyds Bank"



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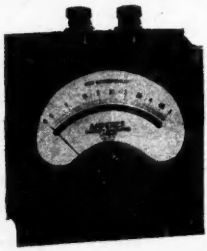

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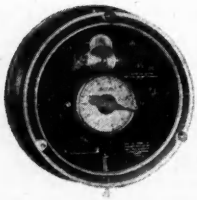

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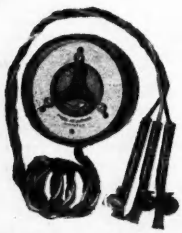

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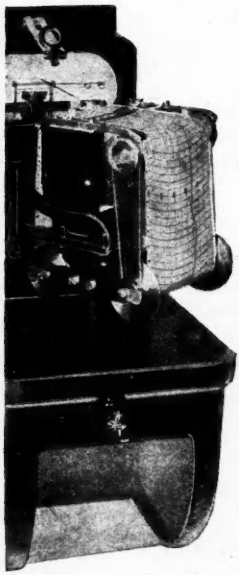

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THE
ELECTRICAL REVIEW
THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXIX. No. 3335. OCTOBER 24, 1941 6d. WEEKLY

The Export Position

Safeguarding Future Trade

As we have already pointed out, in the earlier stages of the war when we wished to purchase all the material we could in the United States it was essential to raise as much dollar exchange as possible. This was largely accomplished by the transfer to the Treasury of British holdings of American securities for realisation when favourable opportunities occurred. The other principal method was to maintain, and if possible extend, our exports to countries outside the sterling area, which meant very largely Latin America and the United States themselves.

Since those days many things have happened and the whole aspect of our overseas trade has been changed, particularly by the Lend-Lease arrangements with the United States. It is quite obvious that while we are receiving supplies of materials from across the Atlantic we shall not export goods made up of similar materials to our former markets unless it can be shown without any shadow of doubt that the equipment so supplied is vitally needed for the prosecution of the war.

So far as electrical supplies to the Dominions are concerned this is not difficult. They are all on a war footing and, like us, cannot waste their resources on non-essentials, and so it can safely be said that any electrical plant which they purchase from us is for war purposes.

Even so, it might be maintained that they could obtain this equipment directly from the United States but this is not the simple matter which it might appear to be. While in many matters the Dominions have adopted American standards this is generally true only of the "utilisation" equipment. So far as the heavier generating and distributing plant is concerned British practice is followed—in frequency and voltage, for instance.

This being the case it would be difficult for American manufacturers to meet requirements, which to them are of a special character; in fact with their own preoccupation with defence production it might be quite impossible. Consequently they will not consider it a breach of faith for British manufacturers to meet the urgent demand which they themselves could not possibly satisfy without inordinate delay.

Outside the Empire, of course, the case is different. Although there may be rare and exceptional instances in which, by an understanding with America, we may supply equipment to foreign countries, they are negligible.

What then should our attitude to these markets be? Must we give the impression that we have totally abandoned any idea of further trade with them at present and perhaps for ever? This would be a "defeatist" attitude which would be inimical both to our present cause and our future existence.

On the contrary, we must endeavour to keep open the life lines of our overseas trade, and in this respect a breathing space may actually be of advantage to us. It may give us time to revise our

ideas of export trade, to reorganise our contacts in foreign markets and improve our methods.

It is therefore neither foolish nor criminal to keep our friends in these countries acquainted with the names of our manufacturers and their capabilities in whatever way we can. One way is by advertisements in journals read by foreign buyers. We must, of course, not hold out false hopes of immediate deliveries but we can explain the situation, if explanation is needed, to enable them to appreciate the reasons for our present inability to meet their needs, and ask them to continue their goodwill until we are once more in a position to resume normal relations with them.

One Voice

THERE are many shades of opinion regarding the ways in which electricity should be used to assist national reconstruction after the war. What the Minister of Works and Buildings will require, however, is that the views of electrical men should first be sorted out and served to him "on a plate"—on one plate only. This can be done only by a representative body that is able to offer disinterested advice, and the professional character of the Institution of Electrical Engineers makes it the most suitable channel of approach to the Government. From the particulars of the constitution of the I.E.E. Post-War Planning Committee and Sub-Committees given on another page it is clear that the machinery devised by the Institution and the men driving it have been well chosen for the end in view.

Knowledge Exchange

As engineering becomes more diversified, so the need increases for the individual practitioner to supplement the specialised knowledge which he requires for his own work by general information about what has been accomplished in other branches. To make this practicable is a duty of the technical Press, but there should also be scope for a national engineering council created for the purpose of organising a free exchange of experience between the various institutions, as suggested by Mr. R. W. Gregory, chairman of the I.E.E., North-Eastern Centre. In thus enlarging the sphere of their function of maintaining the standard of technical knowledge, the institutions would compensate to some extent for their inherent unsuitability to exercise any considerable measure of control over professional conduct.

Wartime Street Lighting

IN explaining why it was not possible to employ higher intensity street lighting and switch it off suddenly in the event of an alarm, Mr. P. J. Robinson, of Liverpool, mentioned the possible danger of lights being accidentally switched on by bomb effects during a raid and said that to guard against this the lamps had been removed from Liverpool's street-lighting standards. This is not only a very wise precaution, as events elsewhere have shown, but a sensible economy. It can do lamps no good to be exposed to damp, cold, dust and damage for the period of war and most of those left in position will require replacement when the lights are switched on once again.

Too Long

SOME time ago we remarked upon a regrettable tendency in the electrical industry to bestow upon its organisations inordinately long titles and quoted examples. Consequently we are not very pleased to learn of any extension of an existing designation such as that decided upon by the A.M.E.E., which has become the Association of Mining Electrical and Mechanical Engineers. We fully realise the necessity for avoiding confusion with the Institution of Mining Engineers, which accounts for the "electrical and mechanical," but this might have been achieved by a shortening of the title to "Association of Colliery Engineers" which would afford the required distinction. Of course the initials have already been booked by the consultants, so perhaps "Society" might be better than "Association."

Coal Clause Suggestion

LARGE electricity consumers in Leeds whose supply contracts embody a "coal clause" have made a proposal which, so far as we can recollect, has never been put forward before. It is one which, while it may be strictly equitable, would tend, if adopted, to complicate still further already complicated methods of charging. The suggestion is that in operating the coal clause, account should be taken not only of rises and falls in price, but also the quantity of coal used per kWh. The matter has been referred to the Electricity Commissioners for their observations.

Measurement of pH

Instruments for Industrial Applications

By T. Thorne Baker,
F.Inst.P., A.M.I.E.E.

THE ever-present power plant problem of corrosion in boilers and feed pumps is one of the numerous examples into which the measurement of pH enters. The choice of materials for pump construction should be dictated by the pH concentration of the liquids that are to be dealt with, which likewise governs liquor control in flue-gas washing. The electro-deposition of non-tarnishing films on silver depends largely for its success on the pH value of the solutions used. In the rapid production of heavy nickel deposits by electro-plating, the pH value of the solution is a most important factor in determining the physical properties of the deposit. Tensile strength and hardness increase with rising pH, elongation or ductility decreases. The pH value of the soil in which metallic pipes are buried has similarly an important effect on their behaviour. The separation of ores from foreign dross and of one ore from another has been greatly simplified in recent years by pH control.

These random examples are symbolic of the close influence of pH reactions on industrial processes, the study of which has increased the range of works apparatus available for the measurement of hydrogen ion concentration, or pH, of the liquids involved. Half a century ago it was sufficient to dip a piece of litmus paper into a solution or bath to see whether it were acid or alkaline. Acids turn litmus red, alkalis turn it blue. Quite definitely, however, there were "strong" and "weak" acids which could not be differentiated in this way, nor by the ordinary methods of chemical titration. Boric acid is mild and healing, applicable to the eyes or to an open wound; yet an equivalent amount of sulphuric or nitric acid would cause dangerous corrosion.

When acids, alkalis, or salts, are dissolved in water a proportion of the quantity dissolved becomes dissociated into atoms or groups of atoms which carry positive or negative charges. All acids, alkalis and salts break down to a more or less extent when dissolved. In the case of a strong acid like hydrochloric, 78.4 per cent. of the amount contained in one litre of a "normal" solution (containing 36.5 grammes) is dissociated into positively charged hydrogen atoms and negatively charged chlorine atoms. Even water itself becomes dissociated to some extent, breaking down into positively charged hydrogen atoms and negatively charged hydroxyl ions, represented by H^+ and OH^-.

By the law of mass action the product of the concentration of each remains constant. If acid be added to the water, the number of H^+ ions is increased, and the concentration of OH^- ions is decreased. The greater the concentration of hydrogen ions the "stronger" will the acid be, whereas alkalinity increases with increasing concentration of hydroxyl ions. The concentration of hydrogen ions (which is the easiest to measure) in a solution represents a degree of acidity or alkalinity which is fundamentally informative, presenting a simple numerical picture to the metallurgist, industrialist, or chemical engineer.

In the case of pure water, at a temperature of 22 deg. C., one ten-millionth part of its mass is dissociated into H^+ and OH^- ions. The logarithm of one ten-millionth, or 10^{-7}, is -7 and, neglecting the negative sign, 7 is said to be the pH of water, representing neutrality. An acid solution will have a *lower* pH than 7, indicating

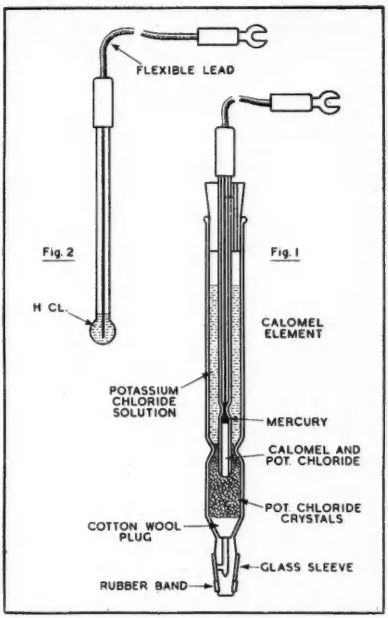


Fig. 1.—Representative glass electrode and (fig. 2) typical glass-hydrogen electrode

that it contains a greater number of hydrogen ions relatively, while an alkaline solution will have a pH higher than 7. A normal solution of strong acid (containing in one litre its molecular weight in grammes divided by its valence) will have a pH of little more than 0, while a normal solution of a strong alkali will be about 14.

The range of pH to be measured in ordinary practice is thus usually from 0 to 14, with a midway neutral point of 7. Temperature, however, can play an important part, as is shown by the fact that water, the pH of which is 7 at 22 deg. C., has a hydrogen ion concentration 25 times greater when heated in a boiler to 225 deg. C., thus becoming distinctly acid in character. For this reason it is customary to control the pH value of feed water to boilers within from 9.5 to 11.5 pH, keeping it on the alkaline side.

Since the reactive quality of a solution does not depend on the total acidity as indicated by chemical titration but the *effective* acidity, how is the latter measured electrically by means of the hydrogen ion concentration? If an electrode of suitable design is immersed in a solution, an electric potential is developed between the two, and this potential is related to the H+ concentration or pH. If the pressure of hydrogen is one atmosphere and the solution contains one gram-ion of H+ per litre, the electrode may be regarded as being of the same potential as the solution. If the concentration of hydrogen ions is above normal the tendency will be for them to deposit on the electrode, giving it a positive charge, while in cases in which the concentration of hydrogen ions is below normal the electrode will acquire a negative charge.

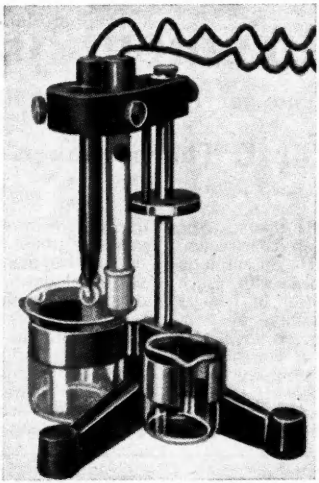


Fig. 3.—Marconi-Ekco electrode and beaker holder

While the standard of reference is a "hydrogen electrode," consisting, for example, of a platinum wire coated with platinum black round which hydrogen gas is bubbled, the "glass electrode," described below, is the

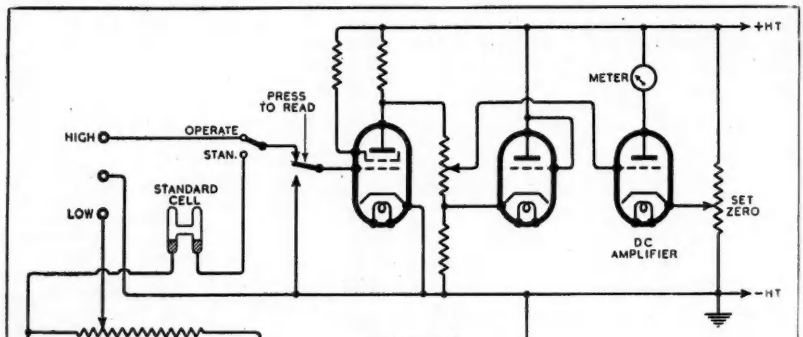


Fig. 4.—Wiring diagram of Marconi-Ekco portable meter with amplifier

more convenient form for works estimations. The circuit must, however, be completed through a second electrode in contact with the solution, and this must not vary in potential with respect to the liquid with any change in the pH of the latter.

The electrode ordinarily employed makes contact with the solution through a saturated solution of potassium chloride (fig. 1) which is kept saturated by an excess of crystals of the salt seen in the base. Liquid connection is made with the solution under test through an orifice in the base covered by a ground glass tapered sleeve held by a rubber band. Half immersed in the potassium chloride solution is the calomel half-cell.

Fig. 5.—Cambridge portable pH meter suitable for use in works

The glass hydrogen electrode, which has been adopted on a wide scale for industrial work, depends upon the fact that a potential is set up across a thin glass membrane that separates two solutions each of which has a different pH value. A sealed high-conductivity glass bulb (fig. 2) is blown at the end of the tube, the bulb containing hydrochloric acid into which a silver wire dips. Owing to the high resistance of the glass a thermionic valve is used in the potentiometer circuit. If the instrument is standardised on a solution of known pH before use, the readings will be linear and the galvanometer can be calibrated to read in pH units directly.

The portable pH meter made by the Cambridge Instrument Co. (fig. 5) is an excellent example of modern electrometric apparatus. It is completely self-contained in a portable box, and can thus be taken to different parts of the works and used on site. The electrode system comprises a sealed glass and a single calomel electrode. Working over the range of 0 to 14 pH units, the scale of the meter is calibrated in divisions of 0.02 pH, while a change-over switch enables the instrument to be read in millivolts over a range of 0 to 1,400. The galvanometer acts as a null point detector, so that the calibration is independent of valve characteristics.

Remote indicating outfits by the same company (fig. 6) comprise a mains-operated pH potentiometer with a transparent illuminated scale; the portion of the scale visible at any time covers a range of 5 pH, and can be made to appear in white for 2 pH on either side of the point which represents the processing value, and red on the side above the pre-set range, green below. The operator can in this way see the state of the pH at a glance from a distance. With a continuous flow type of apparatus a further possibility is offered, which, used in conjunction with the Model B recorder (such as is used for temperature and CO_2 measurements) shows the pH on a horizontal scale and inks a trace on a travelling chart.

For the continuous flow system (fig. 7) the electrode holder is fitted directly into the pipe line, and the solution is fed through an outer bowl of rubberised metal or glass from the watertight

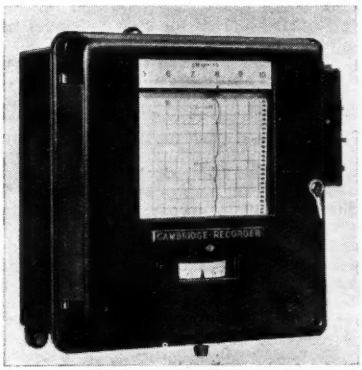


Fig. 6.—Inking recorder with travelling chart (Cambridge)

head from which the electrodes depend. A further refinement is the recording automatic pH *regulator* which operates an inlet valve whereby either acid or base can be added to the solution until the departure from a set pH value has been restored.

The Marconi - Ekco mains - operated equipment is built into a cast aluminium case, 15½ by 13 by 8½ in., and weighs about 38 lb. A two stage DC amplifier is incorporated, enabling a robust pivoted galvanometer to be employed. Stabilising and smoothing circuits make the galvanometer deflection perfectly steady and unaffected by mains voltage fluctuations within the limits of ± 6 per cent. For works processing a dip or flow electrode is recommended. The dip assembly comprises a head carrying a glass electrode of the silver/silver chloride type, calomel cell and temperature compensator, which are protected by an open framework of stainless steel. An industrial continuous flow assembly consists of an enamelled steel chamber having inlet and outlet pipe connections, and is rendered liquid-tight by the use of suitable gaskets. The automatic temperature compensation claimed for Marconi-Ekco indicators is an important item, as the resistance of the bulb of the glass electrode becomes approximately halved for each 8 degrees rise in temperature.

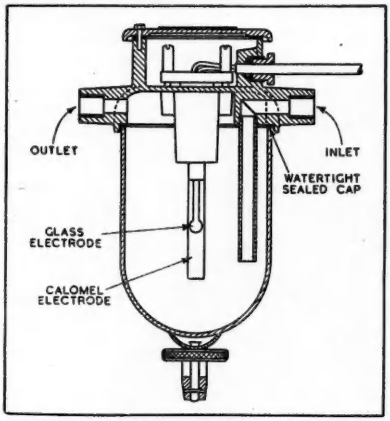


Fig. 7.—Cambridge continuous-flow electrode assembly

The Beckman industrial model is typical of modern pH apparatus. Contained in a small case, 13½ by 9½ by 9 in. and weighing only 23 lb., it reads directly from 0 to 7 or 7 to 14, the acid and alkaline ranges being selected by a switch. It is fitted with a shielded glass electrode and companion calomel electrode, both of them the size of an ordinary fountain pen. The electrodes, which are connected with the case by a pair of high-insulation cables, are immersed in the test solution in a beaker provided. A buffer solution for standardising and a supply of potassium chloride solution for flushing the calomel electrode are contained in the case. The meter is adjusted for operation at 25 deg. C.

While the hydrogen electrode may be regarded as the perfect standard, the glass electrode has taken precedence for portable apparatus for general industrial work, and is, indeed, rapidly becoming the standard electrode for most pH measurement. It does not, however, give a zero potential for 0 pH, but an "asymmetry potential" which depends on the individual electrode and may change slowly from time to time. Hence before a measurement is made the instrument is first checked with a buffer solution at the temperature concerned. These solutions are of known pH value which resist changes in hydrogen ion concentration. Their pH is practically unaffected by the addition of small quantities of acid or alkali.

Whereas the addition of hydrochloric acid to a solution of one of its salts (such as sodium chloride) would change the pH by the amount of H+ ions added, the same quantity of acid added to a solution containing sodium acetate and acetic acid would show a very much smaller change, as the hydrochloric acid reacts with some of the sodium acetate to form sodium chloride and acetic acid, the latter being a weak acid. Buffer solutions ordinarily consist of a weak acid (or alkali) in conjunction with one of its salts, and in this way can be prepared so as to have a definite pH for standardising purposes. A buffer solution of potassium phthalate is much used as it has a more or less negligible temperature coefficient.

Simpler outfits are obtainable from most laboratory furnishers, and the most remarkable feature of recent pH apparatus is the ease and rapidity with which they enable measurements to be made, features that can best be appreciated by those familiar with the early technique of only a very few years ago. Both the Cambridge and Marconi-Ekco companies provide handbooks treating of the important subject of hydrogen-ion concentration and the measurement of oxidation-reduction potentials, List No. 108A just issued by the former concern being particularly recommended to those interested in studying the subject. Free reference to the booklet has been made by courtesy of the Cambridge Instrument Co.

Mining Engineers

AT the opening meeting of the Lanarkshire Branch of the Association of Mining Electrical and Mechanical Engineers recently, Mr. A. H. Harle, branch president, delivered his address. Awards were presented as follows:—Association prizes.—Mr. D. Scott, A.M.I.E.E. (Cadzow Colliery) and Mr. J. D. C. Napier (West Africa). Branch prizes.—Mr. A. B. Macdonald (Coltness Iron Co.) and Mr. D. Scott.

I.E.E. Officers

New President and Section Chairmen

HOW much the country in its present need owes to radio engineering will doubtless one day be plain to all. Enough is generally known now, however, to make it evident that the debt is one of indisputable magnitude. It is therefore fitting that the Institution of Electrical Engineers has chosen as its President for the new session one so widely identified with the subject of radio as **Sir Noel Ashbridge,** Controller of Engineering of the British Broadcasting Corporation, who delivered his inaugural address yesterday afternoon.

Sir Noel, who is in his fifty-second year, was born at Wanstead, and received his education at Forest School and his engineering training at King's College, London, of which he is a Fellow. After some years of practical experience with Yarrow & Co., Ltd., and the British Thomson-Houston Co., Ltd., his career was interrupted by the war from 1914 to 1919, throughout which period he served in the armed forces, first with the Royal Fusiliers and then with the Royal Engineers. On demobilisation he was engaged by Marconi's Wireless Telegraph Co., Ltd., at the Writtle Experimental Station. In 1926 he joined the B.B.C. as assistant chief engineer, subsequently being appointed to his present position.

Becoming a member of the Institution in 1933, Sir Noel soon took an active part in directing its affairs. In the following year he was elected to the Council and in 1937 accepted the responsibilities of vice-presidential office. In association with Messrs. H. Bishop (the new chairman of the Wireless Section) and B. N. MacLarty, he presented a paper in 1935 on the Droitwich broadcasting station, which was awarded the Institution Premium. He also prepared the "Review of Progress of Broadcasting and Television" which appeared in the *Journal* of the I.E.E. for March, 1939. Among his other contributions to the literature of the subject have been the books "Wireless Valve Receivers and Circuits" (with R. D. Bangay) and "Acoustical Problems of Broadcasting Studios."

In addition to the distinction of knighthood, which was conferred on him in 1935, Sir Noel is Knight of the Royal Order of Dannebrog (Danish). Membership of the Radio Research Board and of the Television Committee denotes his close association with the developments that have taken place of recent years under official auspices.

Such contacts as these should serve the Institution in good stead in its collaboration with the Government in the coming year, during which the efficiency of electrical engineers generally is likely to be tested to the utmost. Our wishes that Sir Noel Ashbridge may have a successful year of office are therefore linked with our hopes for an early and triumphant issue by our country from its present time of stress.

Above: Sir Noel Ashbridge (President). Left to right: Messrs. H. T. Young (Installations Section), W. Phillips (Meter & Instrument Section), H. Bishop (Wireless Section) and S. W. Melsom (Transmission Section)

One of Sir Noel's colleagues, **Mr. Harold Bishop,** assistant chief engineer to the B.B.C., is chairman of the Wireless Section of the Institution.

Mr. Bishop was born in London in 1900, and was educated at Alleyn's School and the City and Guilds Engineering College, taking the B.Sc.(Eng.) degree. After serving an apprenticeship with the Argus Engineering Co., Ltd., he became a technical assistant in the Engineering Division of H.M. Office of Works. He joined

Marconi's in 1922, and in the following year was appointed superintendent engineer in connection with "2 L O"; he then became senior superintendent engineer to the British Broadcasting Co., Ltd., remaining in that position when the Corporation was formed. He became assistant controller (engineering) in 1929.

Mr. Bishop is a C.B.E. and a member of the Institution of Mechanical Engineers, as well as an associate of the City & Guilds College.

Mr. H. T. Young, who is first chairman of the Installations Section of the Institution of Electrical Engineers, is governing director of Troughton & Young, Ltd., Knightsbridge, S.W. Mr. Young has been associated with this company for over twenty-five years, having occupied the position of employee, junior partner and proprietor previous to its being converted into a limited company. He received his practical training with Rawlings Bros., and his technical training at the South Western Polytechnic.

He has served the electrical industry on many committees and councils for several years past, and his first office with the I.E.E. was as a member of the Informal Meetings Committee. He was elected to the Council for the years 1927-30, was a vice-president for the years 1932-35, and became president of the Institution in 1936-37. He represented the I.E.E. on the E.D.A. Council for five years, and has been on most of the I.E.E. internal committees; he has also taken a special interest in the Students' Section. He was for three years a member of the Council of the Illuminating Engineering Society and received the first award of the Leon Gaster Premium.

Mr. S. W. Melsom, who is chairman of the Transmission Section, is technical officer to the Cable Makers' Association. Following an apprenticeship with Crompton & Co., during which he worked personally with Colonel Crompton, one year in South Africa and another as assistant engineer in the then new Wood Lane station of the Kensington and Notting Hill companies, he joined the National Physical Laboratory, being one of the first few members of the staff under Sir Richard Glazebrook. For most of the twenty or so years which he spent there he was responsible for the work of a section and its organisation. During this time, and generally in collaboration with his assistant, Mr. H. C. Booth, a number of now classical papers on various electrical subjects were published, mainly on current rating and allied problems relating to power cables. The first call for data of this type came from the I.E.E. and the first paper on the subject, published in 1911, formed the basis of the revised tables of current rating in the I.E.E. Wiring Regulations.

He left the N.P.L. to become head of the Research Department of Callender's Cable & Construction Co., Ltd., leaving them in 1930. After a period devoted mainly to inventing and successful development of a new resistance element he rejoined the cable industry in 1935 as technical officer to the Cable Makers' Association.

Mr. Melsom has twice served on the I.E.E. Council for the normal period of three years, and on two occasions has been a British representative at overseas Conventions. He has received three premiums for I.E.E. papers. He served on the Wiring Regulations Committee for many years and was chairman of the Cables Sub-committee. He is a member of a number of E.R.A. and B.S.I. committees. Since the war commenced his work has been mainly devoted to the cable requirements of the Services.

Mr. W. Phillips is chairman of the Meter and Instrument Section. He was educated at Berkhamsted Grammar School and Central Technical College, where he obtained the diploma of A.C.G.I. He was also a City and Guilds silver medallist (electric light and power). After a short period with Veritys, Ltd., he commenced his association with Elliott Brothers (London), Ltd., in 1896, with whom he is now technical engineer.

Mr. Phillips is chairman of the E.R.A. Sub-Committee for Fibrous Insulation Materials and is also a member of other sub-committees. He is a member of B.S.I. committees for insulation materials and of the B.E.A.M.A. Technical Sub-Committee for Measuring Instruments and Transformers. He went to Paris in 1937 and Torquay in 1938 as a member of the British Delegation to the International Electrotechnical Commission.

Forthcoming Events

Institution of Electrical Engineers.—*Wireless Section.*—Wednesday, November 5th, 4 p.m. London. Inaugural address by the chairman, Mr. H. Bishop.

Meter and Instrument Section.—Friday, November 7th, 4 p.m. London. Inaugural address by the chairman, Mr. W. Phillips.

Transmission Section.—Wednesday, November 12th, 4 p.m. London. Inaugural address by the chairman, Mr. S. W. Melsom.

Installations Section.—Thursday, November 13th, 4 p.m. London. Mr. A. G. Ramsey to open informal discussion on solving wartime electrical problems.

South Midland Centre.—Saturday, October 25th, 12.30 for 1 p.m., Grand Hotel, Birmingham. Wartime lunch; chairman's address by Mr. R. H. Rawll, and brief address by Sir Noel Ashbridge, President of the I.E.E. November 3rd, 6 p.m., James Watt Institute, Birmingham. Paper on "Space Heating by means of Electrically Warmed Floors as applied to Surface Type Air-Raid Shelters," by Mr. R. Grierson.

North-Eastern Centre.—Monday, October 27th, 6.15 p.m. Neville Hall, Westgate Road, Newcastle-upon-Tyne. Paper: "Outdoor Bushings—their Construction, Testing and Standardisation," by Mr. W. A. Cook, B.Sc. *Students' Section.*—Friday, October 24th, 6.30 p.m. Neville Hall. Chairman's address on "Units," by Mr. E. Jeffrey. Friday, November 7th. Old Assembly Rooms, Newcastle. Annual dance.

Association of Supervising Electrical Engineers.—Saturday, October 25th, 2.30 p.m. Lighting Service Bureau, London. Presidential address by Mr. H. W. Swann, M.I.E.E.

Association of Mining Electrical Engineers.—*South Wales Branch.* Saturday, October 25th. Cardiff. Discussion by Mr. J. A. B. Horsley on the report of the Departmental Committee on the amendment of the general regulations governing the use of electricity in mines.

PERSONAL and SOCIAL

News of Men and Women of the Industry

IT was reported at a recent meeting of the Worthing Town Council that although **Mr. E. G. Staygle,** the deputy electrical engineer, was entitled to a salary of £652, he had expressed a desire that his maximum salary should be only £620. In expressing the thanks of the Electricity and Waterworks Committee, the chairman said that pressure had been brought to bear on Mr. Staygle " by the Industrial Council " so that his salary should be increased with those of the rest of the technical staff.

Last week we reported the resignation of **Sir Thomas Higham,** chairman of the Accrington Electricity Committee, because of the Corporation's refusal to adopt the agreement relating to chief engineers' salaries. This has been followed by a request by the borough electrical engineer, **Mr. A. W. Clegg,** to be released from his duties. Mr. Clegg was due to retire on superannuation last year but carried on at the Council's request ; the Council has now agreed to release him in January. The adoption of the agreement would have involved an increase in the engineer's salary from £950 to about £1,400; Mr. Clegg has pointed out that engineers of smaller undertakings were receiving considerably higher salaries than that paid at Accrington.

The Dundee Corporation sub-committee appointed to consider the vacancy caused by the resignation of **Mr. D. H. Bishop,** city electrical engineer, recommends that **Mr. P. Philip,** generating engineer and power station superintendent, shall be appointed to the position. It is proposed that Mr. Philip's salary shall be fixed at £1,000 a year, rising by annual increments of £50 to £1,250. The sub-committee also recommends that **Mr. A. M. Reid,** secretary of the Department, shall be appointed commercial manager at a salary of £700 rising to £800.

Mr. R. C. Golding, M.Sc., A.M.I.E.E., mains engineer with the West Bromwich Corporation Electricity Department, has been appointed deputy borough electrical engineer. He received his technical training at the Rugby College of Technology and Arts and was apprenticed to the British Thomson-Houston Co., Ltd. After a period as senior mains assistant at the Kibworth office of the Leicestershire & Warwickshire Electric Power Co., he was, in 1933, appointed technical assistant in charge of mains at the Caernarvon office of the North Wales Power Co. He was subsequently for a while employed in the operation department of the Central Electricity Board at Bristol, joining the West Bromwich undertaking in 1939. He has made several visits to the United States and the Continent to study electrical progress.

Following the retirement in February next of **Mr. J. W. Speight,** the deputy borough electrical engineer at Leyton, the post is to be abolished and a new position, to be designated technical assistant, created. According to the *Leyton Express,* **Mr. A. Hanscombe,** at present substation engineer, is to be promoted to the new post.

Mr. H. L. Guy, D.Sc., F.R.S., M.I.Mech.E., who recently resigned from the position of chief engineer of the Mechanical Department, Metropolitan-Vickers Electrical Co., Ltd., and as a director of the Metropolitan-Vickers Electrical Export Co., Ltd., will be recommended for the appointment of secretary of the Institution of Mechanical Engineers at a meeting of the Institution which is being held to-day (Friday).

Miss Caroline Haslett was to leave for the United States on October 18th at the invitation of American business and professional women's clubs ; she will be away until Christmas. She will address various organisations and hopes to make an inspection of industry.

Mr. J. D. Parkinson, A.M.I.E.E., has left the employment of the Ayrshire Electricity Board, with whom he was district superintendent, and is going to Nigeria to take up an appointment in the Electrical Branch of the Public Works Department. Before joining the Ayrshire Electricity Board, Mr. Parkinson was with the Yorkshire Electric Power Co., and was previously for some years with the China Light & Power Co.

Mr. A. R. Pike has been appointed sales manager of the Rheostatic Co., Ltd., and has taken up his duties at the company's head office in Slough. He will continue his activities in the London area where he will in future be assisted by **Mr. R. Small. Mr. A. T. Abate** has been appointed assistant sales manager to the company, and his successor in the Birmingham area will be **Mr. C. S. Walker,** who in turn is superseded in the Manchester area by **Mr. S. G. Ward.**

In the account of the career of **Mr. H. Cobden Turner** in our issue of October 10th we incorrectly stated that he founded the Meter Department of the Electrical Apparatus Co., Ltd. We should have said that he founded the AC section of the department, Mr. E. B. Schattner, the late chairman of the company, having already organised the manufacture of DC meters.

Mr. W. Shearer has been appointed director and chairman of the Perak River Hydro-Electric Power Co. and chairman of the Scottish Power Co. in succession to the late Mr. George Balfour.

Mr. A. G. Jones has been appointed sales supervisor with Hammans Industries, Ltd., of Sutton, Surrey.

Obituary

Mr. J. F. Hiddleston, electrical engineer, for many years associated with the Craigpark Electric Cable Co., Ltd., died recently in Glasgow.

Mr. E. O. Catford.—The death is announced of Mr. E. O. Catford, Portobello, who was for many years chief electrician in the Edinburgh Corporation Transport Department. He was well known as a lecturer on electrical subjects, and was for fourteen years the editor of " Speed," the Edinburgh Corporation Transport magazine. Mr. Catford joined the Edinburgh and District Tramway Co. in 1916, and continued in the undertaking when it was taken over by the Corporation in 1919. He retired in 1938.

Will.—Sir George Keith Buller Elphinstone, K.B.E., chairman of Elliott Brothers (London), Ltd., left £31,574 with net personalty £29,722.

Temperature and Resistance

Graphic Method of Obtaining Relationships Rapidly

By W. Bacon, B.Sc.(Eng.)

A CALCULATION which has very frequently to be made in electrical engineering is that of increase of resistance with temperature. The charts accompanying this article are intended to facilitate this. They present the familiar results in a new form.

If a resistance has a value R_1 ohms at t_1 deg. C. and a value R_2 ohms at t_2 deg. C., then the formula commonly used for calculating the rise of temperature (t_2-t_1) is $R_2=R_1(1+\alpha(t_2-t_1))$ where $\alpha = 0.00393$.

In dealing with practical things it often saves a great deal of time if a rough idea of the result can be obtained without calculation. For example, if a resistance of 4.3 ohms increases to 6.4 ohms, the change is obviously around 25 per cent. It would be very useful if an estimate of the temperature rise could be quickly arrived at from this figure. This cannot readily be seen, however, from the ordinary formula. This is therefore rearranged as follows :—

Since $R_2=R_1(1+\alpha(t_2-t_1))$, $\therefore \frac{R_2}{R_1}=1+\alpha(t_2-t_1))$, $\therefore \alpha(t_2-t_1)=\frac{R_2-R_1}{R_1}$ $\therefore t_2-t_1=\frac{R_2-R_1}{R_1\alpha}$ therefore increase of temperature, in deg. C.= (per cent. change of resistance) $\times$ 2.61.

Chart 1 is a plot of temperature increase in degrees C. against percentage increase of resistance on this basis. A given change can

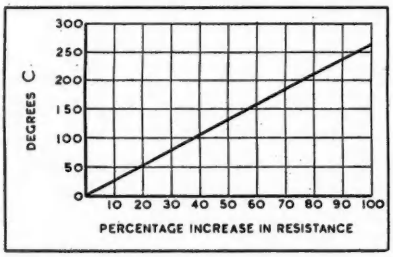


Chart 1.—Increase of resistance with temperature

generally be easily estimated in per cent. Chart 1 then immediately indicates temperature rise and thus provides a quick means of finding an approximate result.

Error with Usual Formula

The formula $R_2=R_1(1+\alpha(t_2-t_1))$ is not quite correct. The true formula is $R_2=R_0(1+\alpha(t_2-t_0))$, where R_0 = resistance at 20 deg. C. and t_0 = 20 deg. C.

The error may be calculated as follows. $R_1=R_0(1+\alpha(t_1-t_0))$ and $R_2=R_0(1+\alpha(t_2-t_0))$ $\therefore t_1-t_0=\frac{R_1-R_0}{\alpha R_0}$ and $t_2-t_0=\frac{R_2-R_0}{\alpha R_0}$ $\therefore t_2-t_1=\frac{R_2-R_1}{\alpha R_0}$, but $R_0=\frac{R_1}{1+\alpha(t_1-t_0)}$ $\therefore t_2-t_1=\frac{R_2-R_1}{\alpha R_1}(1+\alpha(t_1-t_0))$.

The formula previously used is $t_2-t_1=\frac{R_2-R_1}{\alpha R_1}$. Hence the error is $100\alpha(t_1-t_0)$ per cent. and is to be added on to the result originally obtained.

From this Chart 2 has been constructed. The result obtained from Chart 1 may be

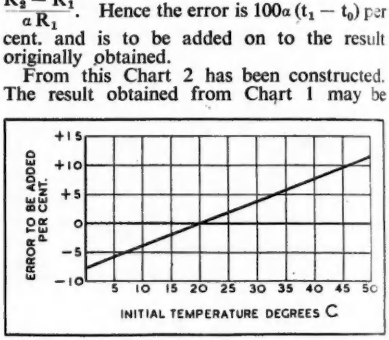


Chart 2.—Correction of error

corrected by adding on the error corresponding to the initial temperature, found from Chart 2. Normally this will be small.

Soil Resistivity

APPARENTLY similar samples of soil from different localities, as well as soils differing in composition, may vary in resistivity very considerably. Some figures of the measured resistance of various soils taken from different localities by the United States Bureau of Standards have been collated by the *Electrical World*. Average, minimum and maximum values of resistance in ohms, when using $\frac{3}{4}$in. by 60in. copper rods, are given as follows:—(1) Ashes, cinders and brine waste, 14, 3.5, 41; (2) clay, shale and loam, 24, 2, 98 ; (3) ditto with varying proportions of sand and gravel, 93, 6, 800 ; (4) gravel, sand, stones with little clay or loam, 554, 35, 2,700.

Corresponding calculated values of resistivity in ohms per cm^3 for these four groups are:—(1) 2,370, 590, 7,000; (2) 4,060, 340, 16,300; (3) 15,800, 1,020, 135,000; (4) 94,000, 59,000, 458,000. In the above figures temperature and moisture content have been disregarded.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions

Carbon Lamp Prices

YOU will be aware of the advantages claimed for radiant heat as a simple and safe method of treatment for many common ailments. Personally I subscribe to the opinion of many who believe in localised warmth as a natural treatment for the relief of pain. You will also know that the radiant heat lamp is the simplest possible piece of apparatus, consisting only of a carbon lamp in a portable reflector fitting.

The matter that concerns me is the apparently excessive price charged for these carbon lamps. Doubtless you will remember that before the introduction of the metal filament lamp the carbon lamp was used almost exclusively for ordinary lighting, and the price was about 1s. for standard wattages. It would be interesting to know why the prices charged for carbon lamps used in conjunction with radiant heat lamps vary from 6s. 6d. to 11s. 6d. each, plus purchase tax.

It will be generally agreed that if all the claims made for radiant heat treatment can be substantiated, then there should be one of these lamps in every house, and if the lamps were available to the public at the original price charged for carbon lamps, even the poorest of the poor could enjoy the benefit of radiant heat. Thinking also in terms of electrical development, what a nice little increase in units sold could be derived from this potential source of revenue, and incidentally what a fine avenue for post-war employment in the flexible cord and reflector fitting industry.

I feel sure that your readers would be interested to see a statement from the Electric Lamp Manufacturers' Association upon this question.

Swinton, Lancs. H. C. BUSBRIDGE,
Borough Electrical Engineer.

Reconstruction and Radio

PLANS for the post-war reconstruction of Britain undoubtedly give great scope for the increased use of electricity, both in industrial and domestic premises. Unfortunately this increase will, unless energetic steps are taken in good time, result in even more severe interference with radio and television reception.

It seemed, just before the outbreak of war, as though Parliament might, at last, seriously consider the question of compulsory interference suppression, but this was shelved for the time being and it seems likely that in the press of post-war legislation on other matters it will again be deferred.

It appears to me, therefore, that it is not too soon for the I.E.E. to give the whole question its earnest consideration; it should not only issue recommendations but also press all manufacturers of interference-producing equipment to make a start *now* in equipping their productions with suppression devices. Considerable research has been carried out, both by the Post Office authorities and by private firms, and the results of this are available to all those interested.

It is obviously simpler and more economical for the work to be carried out now, rather than wait for the coming of compulsory legislation. So let us get on with the job and save the radio dealers and listeners a repetition of their pre-war headaches.

Stoke-on-Trent. G. MORGAN.

Training for Installation Work

HAVING started in the electrical trade at the age of eighteen years, after taking a course at a Government Training Centre, I should be very glad to have your readers' opinions on the best way to secure advancement. What examinations would it be advisable to work for? At present I am wiring conduits and I wish to continue in the electrical trade after the war.

*London, E.*1. H. SANDERWITCH.

Commercial Staffs' Salaries

MR. NOLAN'S letter in your issue of September 12th, relative to the salaries of commercial assistants, containing an assurance that N.A.L.G.O. would take up the case of commercial assistants on request, made particularly piquant reading in view of my relations with that body.

In May last, my Electricity Committee made a recommendation to the Salaries and Wages Sub-Committee of the Town Council that my appointment of commercial assistant in the Electricity Department, which I had held for a probationary period of some eighteen months should be confirmed with an increase in salary.

The recommendation was referred back to the Electricity Committee by the Salaries and Wages Sub-Committee pending the formulation of a new scale of salaries by a joint consultative committee composed of members of the Council and members of N.A.L.G.O., and upon this coming to my knowledge I wrote to the local branch hon. secretary of N.A.L.G.O. on May 19th, requesting him to give me an assurance that the recommendation of the

Electricity Committee would receive the support of the Association, and that the appointment should not be compared with positions in other departments which bore no relationship towards it.

After an interval of nearly three months, during which time I sent two reminders, I received a reply to the effect that the branch could not give me an assurance that any particular type of post could be included in the recommendations should the Council decide to revise the grades.

Being dissatisfied with this decision, I brought the facts to the notice of the general secretary of the Association, who informed me that the matter had been placed in the hands of the Regional Officer, Midlands and South Wales. Then followed a somewhat lengthy correspondence with the Regional Officer, who steadfastly supported the local branch in its refusal to give me the desired assurance, and finally brought me back to the starting point by suggesting that I should ask the N.A.L.G.O. representatives on the joint consultative committee to discuss the matter with me. Thereupon I resigned from the Association after a membership of about twenty years.

I have since been informed that at a meeting of the joint consultative committee the N.A.L.G.O. members unanimously voted against an increase of salary in my case unless other members of the Corporation staff carrying out duties quite dissimilar to my own were placed on an equal footing.

I did not ask N.A.L.G.O. to fight a case on my behalf, but merely requested its assurance that it would include in its proposals my appointment at a salary which had been conceded by my employing Committee, and in view of the response which I received I leave it to commercial assistants in the electricity supply industry to judge for themselves whether membership of such a body is likely to improve their status.

West Bromwich. J. H. RICKWARD.

Heavy Test Resistances

THE article by Mr. D. W. Mackie on this subject in your issue of October 17th, describes a method which I used during the last war, except that circumstances reduced me to the use of large tubs, and slide rails and c.i. bases for electrodes.

One important point has, however, been omitted, *i.e.*, where the load is heavy, and continuous, and supported from a belt-driven generator special care should be taken. It will be found that " gassing " at the electrodes will cause fluctuations of load which will build up and probably throw the belt off the pulley.

Sutton, Surrey. W. H. SHIPMAN.

I.M.E.A. Activities

ACCORDING to the *I.M.E.A. Journal* for October the membership of the Incorporated Municipal Electrical Association is now 346 out of a possible total of 366. With the exception of Hull, the non-members are all small undertakings. The Association says it can therefore legitimately claim that it is fully representative of municipal electricity supply authorities.

Centres of the I.M.E.A. are about to be set up in the Central England Area and the S.W. England and South Wales Area and consideration is now being given to the formation of a centre in the N.W. England Area.

The question of the coal clause in Central Electricity Board contracts was raised at the last ordinary meeting of the Association. It is stated that the matter is receiving the earnest consideration of the Council and it is hoped to make further reference to this matter in the very near future.

Price Increases

With regard to the question of increases in electricity charges, it appears that the Government has no intention of making any Order controlling prices, but the I.M.E.A. Council has decided to refer the matter to the Joint Committee of Electricity Supply Associations with a request that an interview shall be sought with the Electricity Commissioners with a view to obtaining some indications of their policy on this question.

In previous issues of the *Journal* members were informed that the Council had agreed to a formula prepared by B.E.A.M.A. for the application of price adjustment clauses. Representations have since been made to the Council which warrant the reconsideration of the whole matter and accordingly the Council has rescinded its approval of the formula. Members are to be informed in the very near future when a definite decision has been arrived at in this matter.

The London Passenger Transport Board (Execution of Work) Order, 1940, relaxes any obligation placed upon the Board under the Defence (General) Regulations, 1939, and would empower the Board to supply electricity to premises in areas adjacent to its property. The question is being inquired into by the I.M.E.A. and representations will be made if necessary.

Wiring Rules and Registration

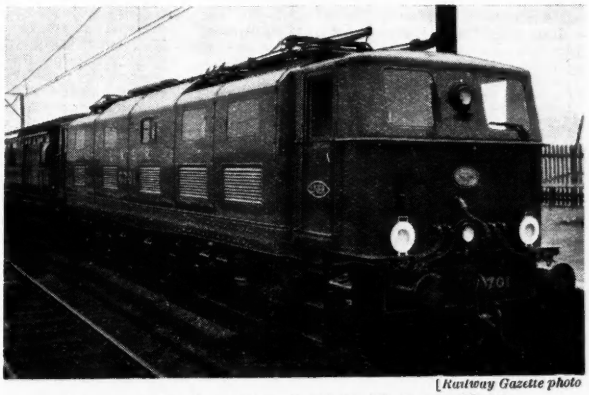
The Council has had under consideration a scheme prepared by the National Committee on Statutory Wiring Regulations and Registration providing for the examination, licensing and registration of contractors, operatives and others engaged in or upon electrical installation work. The scheme provides for the issuing of six licence forms applicable to contractors, supervisors, journeymen, young journeymen or improvers, apprentices, and maintenance men.

It is argued that during the present time when considerable dilution of labour is taking place it would appear inopportune to put the suggested scheme into force. The I.M.E.A. Council has expressed its willingness to agree to the broad principles of the scheme for post-war acceptance and it has also agreed that at the appropriate time it will give due consideration to the question of the licensing of operatives.

New Electric Locomotive

First of Seventy for L.N.E.R. Electrification Scheme

THE new L.N.E.R. mixed-traffic electric locomotive No. 6701 which has recently successfully completed three weeks' trials will make an important contribution to post-war progress in electric traction. It is the first of seventy similar locomotives for the Manchester-Sheffield-Wath electrification scheme which, at the outbreak of war, were being constructed at the railway company's Doncaster works, with electric traction equipment provided and installed by the Metropolitan-Vickers Electrical Co., Ltd. Work on the others was suspended, but it was decided to proceed with the first locomotive, which was in an advanced stage. It will thus be possible to go straight ahead with the scheme after the war instead of awaiting the results of running experience. In the trials, which were carried out over the Manchester-Altrincham electric line, a speed of 64 m.p.h. was reached with seven main-line coaches totalling 250 tons. A total load of 700 tons consisting of 45 loose-coupled loaded coal wagons and two 20-ton goods brake vans was pulled up smoothly within 600 yd. in 80 sec. from 30 m.p.h.



[*Railway Gazette photo*

Locomotive for Manchester—Sheffield—Wath electrification

The locomotive is of the articulated double bogie type and has the following features: (1) Bogie design embodying special springing; (2) electrical compensation of weight transference on starting; (3) regenerative braking; and (4) electrically heated boiler for steam heating of trains. Experience in other parts of the world has shown that it is not easy to obtain smooth running with this wheel arrangement at speeds approaching and over 60 m.p.h. By the adoption of the special springing and by installing motors with a high degree of field control, however, the L.N.E.R. has produced a locomotive which should have a wide range of usefulness.

The length of the locomotive over buffers is 50 ft. 4 in. and its body width 9 ft., the height to the top of the pantograph (locked down) being 13 ft. The total weight is 88 tons. The current is collected from the 1,500-V overhead line by either of two pantographs. The traction motors are provided with forced ventilation and are insulated for 1,500 V, but are connected permanently in two pairs with 750 V across the brushes of each motor. The motors are operated in series and parallel combination and four stages of field weakening are provided. To obtain steady control of the heavy trains on the down gradients from the Woodhead tunnel at the top of the Pennines the motors can also be connected for regenerative braking.

When a heavy train is being started the large draw-bar pull causes a transference of weight from the leading to the rear axle of each bogie and the resulting loss of adhesion might cause the leading wheels to start slipping if the tractive effort were not reduced on these two axles. Control is effected by the driver closing a small low-voltage switch mounted near the master controller which weakens the field of the leading motor on each bogie and so reduces its tractive effort. At the same time a red indicator lamp lights up to remind the driver to open the weight transference control switch and restore conditions to normal as soon as there is no longer need for the extremely high starting tractive effort.

The remote control of the electro-pneumatic contactors and the drum-type switches for reversing, etc., is carried out by 50-V circuits from the master controller, and the low-voltage supply for this purpose is obtained from a 5-kW motor-generator blower set. A second set provides energy for the excitation of the main motor fields during regeneration. The blowers of these two sets, which run

continuously, give a combined output of 9,000 cu. ft. per min. for ventilating the main motors. In the event of the 5-kW motor-generator failing there is a battery of 33 nickel-iron cells having a rating of 40 Ah, which would be able to provide energy for lighting and control, and this battery is normally charged by the generator. For the necessary steam supply a 300-kW, 1,500-V boiler equipped with automatic control has been provided.

The locomotive is fitted with the Westinghouse brake, but it also has a motor-driven exhauster for operating the vacuum brakes on passenger and goods trains. A motor-driven compressor is, therefore, provided, and the compressed air is also used for operating the pantograph and the electrical control.

New Trolley-Bus Services

Installations in Spain, Hawaii and America

IN this country, where the modern trolley-bus was first successfully introduced, the war has necessarily halted the change-over to this form of transport which has been a feature of recent years. Abroad, however, an increasing interest is being taken in the potentialities of the trolley-bus for modernising transport systems, especially in America where many new services are being started.

Last year the first conversion of a tram route to trolley-bus operation in Spain was completed at Bilbao, and a similar scheme is now proposed at Corunna, where the Compania de Tranvias de la Coruna has applied for authority to convert its Juana de Vege-Puerta de Aires and Campo de la Lena-Campo de Marte tram routes. The company at present operates services on 16 route-miles of metre-gauge track, of which three miles are double track.

In Hawaii, the Honolulu Rapid Transit Co has recently taken delivery of 60 new trolley-coaches built by the J. G. Brill Co. and equipped with American General Electric motors, control gear, and air compressors. These augment a fleet of 30 similar, although smaller, vehicles placed in service in January, 1938. The change-over to trolley-coaches of the Kaimuki-Kalihi route, running through the centre of Honolulu, represents the major part of a $1,250,000 modernisation programme planned by the company for this year.

United States Projects

The Georgia Power Co. has started trolley-coach operation with Pullman-Standard 45-passenger vehicles, which are of advanced design and incorporate special features contributing to comfort and safety.

Trolley-coaches for service in Akron by the Akron Transportation Co. were scheduled for delivery last month. Equipment has been erected for the East Market route through to Ellet, and drivers have received instruction at Milwaukee, where similar trolley-coaches are in service. An additional 17 trolley-coaches have been ordered for Des Moines, where 53 are already operating. They will be 44-passenger vehicles and will be used for modernising the Des Moines-West Des Moines route.

Two new trolley-coach routes are planned by the Boston Elevated Railway, and 35 new vehicles have been ordered for the purpose. The Delaware Electric Power Co. is purchasing an additional six 40-passenger vehicles, making 72 in all, and Denver Tramways is supplementing its existing fleet of 35 trolley-coaches with a further seven vehicles.

In a recent address to the New England (U.S.A.) Transit Club, reported in *Mass Transportation*, Mr. E. E. Kearns, of the American General Electric Co.'s Transportation Department, described some interesting experiences in trolley-coach operation. In Cleveland, trolley-coaches and motor-buses were run together on one route, but passengers preferred to wait for the trolley-coaches so that, to even out loads, it was found necessary to run the vehicles in consecutive fleets. Shreveport Railways, having completely modernised its system with trolley-coaches, increased its passengers from 9½ millions in 1929 to 14¼ millions in 1940. A survey at Portland, Oregon, revealed that 80 per cent. of the population preferred trolley-coaches, 9 per cent. voted for the semi-modern street-cars, 8 per cent. showed no preference, 2 per cent. chose motor-buses, and 1 per cent. asked for no additional change.

Public's Choice

In nearly every instance where the public had been given an opportunity of choosing, trolley-coaches had led by a handsome margin. Beginning with the Salt Lake City installation in 1928, nine years elapsed before 1,000 trolley-coaches were in service in America, in about 30 undertakings. The second thousand was added in about two years, a further ten cities being included, and the third thousand, with another ten cities, went into service in eighteen months, while the fourth thousand vehicles were now in process of installation or on order. All of these, from the first in 1928, were still in service operating satisfactorily.

Comparing cos s, Mr. Kearns said that on the average trolley-bus maintenance cost about half as much as with motor-buses, and allowing for the maintenance of the overhead system there was still a substantial advantage in favour of the electric vehicle. Assuming that petrol cost 12 cents per gal. and electricity 1 cent per kWh, a 40-passenger trolley-coach, consuming 3¼ kWh per coach-mile, would cost $400 to $500 less in fuel to operate than a similar motor-bus (2¼ m.p.g.).

The maximum net power which was delivered to the drive of a 40-passenger motor-bus for acceleration did not exceed 150-175 HP, whereas the trolley-coach allowed the use of horse-power in the neighbourhood of 225 to 250 for normal acceleration. This meant an increased schedule speed and the same number of miles per year could be operated with approximately $100-150 less in platform (wage) expenses. In addition, the reliability of the trolley-coach meant that some 5 per cent. fewer vehicles were needed.

INSTITUTION PROCEEDINGS

Electricity in Reconstruction.

Planning for Peacetime

A DISCOURSE on after-war reconstruction prefaced the inaugural address of Mr. R. W. Gregory (consultant) as the chairman of the North-Eastern Centre of the INSTITUTION OF ELECTRICAL ENGINEERS (a position which he held in 1925), at Newcastle-on-Tyne on October 13th.

Study of complete employment in wartime, he suggested, might furnish a guide to the prevention of unemployment in peace, but it would take a long time for this country to change its present methods, which tended to encourage excessive waste, so as to recognise carefulness and thrift and the general husbanding of natural resources as virtues. The primary industries would need to be dealt with first, to assure the essentials of life.

For a start he suggested "looking to the land," declaring that electricity had already ventured quite a long way into the agricultural field; being firmly convinced that it would play a major part in the reconstruction of society that must necessarily follow the conclusion of this war. Foreign food, although it might have been cheap, lacked vitality and, in too many working class families, was deficient in quantity; this combining with unhygienic habits of living, bad housing and poor environment, had necessitated expensive health services.

Decentralisation

The growth of a prosperous farming community would naturally create a tendency to develop country industries based on the production of farms and the needs of farmers. They would all be consumers of electricity, the increased availability of which would make wider dispersal of industries away from crowded centres commercially sound; develop country market towns as centres of trade, education, entertainment; and compact the shapes of sprawling villages. The spread of population more evenly throughout a productive countryside could be assisted by increasing the public services available to countrymen, at prices not seriously higher than those offered to townsmen. Extensive capital works would be involved, which might not for a number of years provide enough revenue to pay reasonable interest on the cost of their construction.

The objective was important enough to justify unorthodox methods of finance and if the need were realised the money would be forthcoming. What would be the effect on the distribution of industries and population if the charges made for essential services were so standardised as to provide the same tariffs for all? There was really nothing outrageous in this idea, since the prices of proprietary products were generally standardised throughout the country without Government control.

For a suggested five-year plan of countryside development Mr. Gregory's choice would be a distribution network consisting of 11-kV three-phase overhead lines, limiting single-phase lines to services to small villages, or one or two farms. Steel wire lines would rarely be used because their capacity and life were both limited. Pilot and telephone lines would not be provided because the national telephone network would be available everywhere. Switchgear would be used sparingly, but automatic reclosing devices for circuit-breakers would be furnished in considerable numbers, together with the simplest forms of protection, the need for which was lessened as the soundness of lines and apparatus was increased. Such design demanded some measure of structural standardisation, which might be extended even to meter boards and connections. In making his plea for revitalising the countryside Mr. Gregory referred to Sweden.

Services to Buildings

In some buildings the costs of the engineering services approached those of the structures themselves, entailing collaboration between architects and engineers, which in future would need to be much closer when planning towns as well as individual factories and buildings.

The enormous improvement in factory lighting brought about by the need for continuous output in wartime, coupled with the better understanding of the art of ventilation, caused Mr. Gregory to wonder sometimes whether it was worth while to pay much attention to glazing for admitting daylight to such places as generating stations, in which artificial illumination had to be used for 65 per cent. of the year, particularly as electric light was available at cost price. In the United States, where site values were high, factories and offices and stores were being built without windows, which simplified the planning of the structure.

The Function of the I.E.E.

In due course I.E.E. members would be asked to consider, in informal discussions, Committee views upon the general policy of the Institution towards post-war reconstruction and development, including any changes that might be desirable in the "structure and machinery" of the Institution itself.

The I.E.E. differed from purely professional associations in that it was more catholic in

Welded Ship Construction.

respect of qualifications for membership, which was open to both manufacturers and users of electrical equipment of all kinds. Membership implied that individuals had attained to a definite standard of knowledge and experience and responsibility. The main business of the Institution was to maintain that standard and, in various ways, to promote the advancement of electrical knowledge. It could never be strictly professional with wide disciplinary powers, nor exercise rigid control of the business conduct of its members.

A weakness of all engineering institutions was that they were too self-contained, knowledge accumulated by any one not being directly available to others. Means should be devised for the free exchange of experience between all engineering and scientific organisations in this country. For that purpose a sub-committee of the North-Eastern Centre had suggested the formation of a National Engineering Council to act mainly as the secretariat of affiliated bodies.

The I.E.E. Prepares

BY setting up a Post-War Planning Committee the INSTITUTION OF ELECTRICAL ENGINEERS has taken a positive step towards increasing the influence of the electrical profession in national affairs. The framework of the scheme appears to be flexible enough to deal not only with the larger issues but also with the lesser anomalies which have hampered this development hitherto and which generally require only a lead from an authoritative body to be put right.

The main Committee of eleven members, including, ex-officio, the president, Sir Noel Ashbridge, should not be too large for rapid action. The chairman is Mr. J. R. Beard, whose presidential address last year foreshadowed the present development. Other members of the Committee are Col. Sir A. Stanley Angwin (5), Dr. P. Dunsheath (2), Mr. V. Z. de Ferranti (4), Dr. A. P. M. Fleming (1), Sir George Lee, Mr. E. Leete, Professor S. Parker Smith, and Messrs. Johnstone Wright and H. T. Young (6). The numbers after the names denote chairmen of the sub-committees mentioned below.

The terms of reference are as follows: To study post-war planning in electrical engineering with the object of making recommendations to the Council from time to time, and in particular to consider and report on post-war development in regard to (1) educational training and personnel; (2) fundamental and applied research; (3) electricity supply, distribution and installation; (4) production, manufacture and employment; (5) telecommunications, reconstruction and development; (6) the general policy of the Institution towards problems of post-war reconstruction and development, including any desirable changes in the structure and machinery of the Institution and in its public relations; and (7) problems of standardisation of materials and design. The Committee is authorised to co-operate with other bodies and persons carrying out similar studies.

For investigating the subjects given under the first six heads sub-committees consisting of from five to eight members have been set up. One of these, No. 3, is already at work and it is sub-divided into six panels comprising: standardisation of voltage and systems; availability of supply and service arrangements; questions of Government control in connection with electrical equipment; simplified regulations for the electrical equipment of buildings and codes of practice for installations; standards of equipment and lighting; and forms of tariffs. The constitution of this sub-committee is as follows: Messrs. J. R. Beard (chairman), J. I. Bernard, P. V. Hunter, Forbes Jackson, J. W. J. Townley, Johnstone Wright, W. J. H. Wood, and H. T. Young. Its problems will be generally similar to those of the new Installations Section, the need for which at this juncture was chiefly in connection with post-war planning. The next meeting of this Section, on November 13th, will be of special importance, however, from the aspect of war conditions.

Matters have not yet progressed far enough to justify the establishment of panels for sub-committees (1), (4) and (5), and the procedure to be adopted in the cases of Nos. (2) and (6) is not yet settled. The question of forming a sub-committee to cover the seventh item is in abeyance. Members have been selected for their personal qualifications and not as representing organisations.

Liaison is maintained with the Institutions of Civil and Mechanical Engineers through a Joint Co-ordination Committee of six members —two from each. In addition there is close contact with the Ministry of Works and Buildings, and Lord Reith has indicated approval of, and interest in, the work of the Post-War Planning Committee.

Mining Regulations

A MEETING of the West of Scotland Branch of the ASSOCIATION OF MINING ELECTRICAL AND MECHANICAL ENGINEERS was held at the Royal Technical College, Glasgow, on October 11th. The principal business was consideration of the proposed amended regulations governing the use of electricity in mines.

A lead to the discussion was given by Mr. J. A. B. Horsley, former Electrical Inspector of Mines. Mr. Horsley replied at length to a number of written questions which had been sent to him from different parts of the Scottish coal fields, and it was explained that the Departmental Committee, in drafting the regulations had aimed at leaving as much discretion as possible to the competent engineers of the collieries. The Committee

had tried to lay down general principles and standards.

Mr. H. A. McGuffie, consulting electrical engineer, Glasgow, pointed out that many collieries would be faced with serious expense if the proposed provisions with regard to surface lighting were insisted on.

Mr. Horsley undertook to reply in writing to various points of criticism which were raised in the course of the discussion.

Electrically-Welded Ships

SHIP design and building technique were compared in the Presidential address of Mr. W. A. Woodeson, delivered on his re-election for a second year of office, at the annual general meeting of the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS at Newcastle-on-Tyne on October 17th.

In the course of this Mr. Woodeson said that modifications in the technique of shipbuilding and allied industries which had taken place in the last twenty-five years were eclipsed by the attention that had been given to the use of welding. This development was fundamental in that it affected the design of the product. Riveting was still the major means of construction in this country, but gradually the saving in weight and material due to welding was becoming more recognised for all constructional purposes. The survey of the effect of welding on the fighting qualities of ships would be one of the most interesting post-war considerations of naval architects, especially in view of the mixed performance of the German capital ships whose construction so largely depended on electric-arc welding.

A certain American shipbuilding concern had laid down a yard and shops expressly equipped to produce nothing but all-welded vessels. This company had something like twenty-six merchant vessels of an important type on order, of considerable size and capacity. The same yard in June of this year launched an all-welded steamship of 17,000 tons, claimed to be the first all-welded passenger-ship built in the world. The results obtained by these vessels should shorten discussions as to the part that welding could play in shipbuilding in the future.

Secondary Equipment

In the last twenty-five years the use of electricity in ships had made considerable progress. Electric motive power had been used as main propelling machinery, but the real progress, up to now, applied particularly to auxiliary machinery. Up to 1916 the progress had been rather disappointing; early performances were somewhat uncertain, and therefore mitigated against its obvious advantages. This uncertainty had largely been removed in the intervening period.

An outstanding development had been the electrification of various types of deck machinery. It still had a higher first cost than steam, but by virtue of its reliability in performance it had proved to be much less expensive than previously. These remarks especially applied to the electric cargo winch.

Electrical deck machinery, materials used in the construction of deck machinery, welded construction and cast steel, largely supplanting cast-iron and semi-steel, the application of ball and roller bearings, particularly for electric motors and steering gear control, had all greatly helped to improve performance in every way.

Electrical Education

AN address on "Education and Training for the Electrical Industry" was given by Mr. H. V. Fields, chairman of the Tees-side Sub-centre of the I.E.E., at the annual meeting of the CLEVELAND TECHNICAL INSTITUTE at Middlesbrough. Mr. Fields said that in far too many directions training methods were unsatisfactory owing to such factors as insufficient variety of work, mass production, exploitation and piecework. He suggested that firms should be debarred from accepting apprentices unless they were prepared to plan and operate an effective scheme of training and where necessary co-operate with other firms in the provision of such training.

Mica Resources

THE Indian Government Trade Commissioner in New York has reported that there is likely to be an increased demand in the United States for Indian mica. In 1939 the United States purchased 7,759,300 lb. of India's exports of 19,893,000 lb.

Commenting on this the *Indian Railway Gazette* stresses the dominant position held by India in the supply of mica upon which the American electrical industry so largely depends. It says that the possibilities of competition are quite small. Madagascar, which is the world's major supplier of phlogopite, or amber mica, which is used for commutator segments, produces only small quantities of muscovite which are consumed in France. Canada is also rich in phlogopite resources, but not in muscovite. Tanganyika has muscovite deposits of the first quality and its deposits of mica once were, and may again become, important. Muscovite mines are also located in Northern and Southern Rhodesia. The Union of South Africa is an important producer of mica, but nearly all of it is scrap.

In Latin America, Argentina and Brazil contain deposits of good quality muscovite and the opinion has been expressed in mica circles in the United States that Brazilian block mica, because of its comparatively low price, may become an increasingly important competitor of India. This is undoubtedly a possibility should supplies from India become, for any reason, unavailable or difficult. Guatemala, Peru and Mexico also have some muscovite deposits, but their total output thus far has been small. Australia has considerable deposits of fine mica, but their inaccessibility makes their early development unlikely.

New Zealand is known to have small quantities of fair muscovite. Chosen and Japan produce mica, but no authentic information can be obtained as to the location, nature or importance of any mica deposits in Japan proper. Information on mica production in the Soviet Union is meagre but it is assumed that mica deposits do exist there. Europe, excluding the Soviet Union, contains only small deposits.

The South Shields Case

Taxation of Local Authorities' Trading Profits

From a Legal Contributor

AS was reported last week, Mr. Justice Lawrence in the King's Bench Division of the High Court has now delivered his reserved judgment in the case of Allchin (Inspector of Taxes) *v.* The County Borough of South Shields. The case is one of great importance affecting the large majority of local authorities throughout the country which possess trading and commercial departments, but it is necessary to defer detailed criticism until a full report of the judgment has been made available to the public through the recognised Law Reports.

Briefly the principle which was tested was one with regard to which some doubt has existed for several years, and it is probable that the case will be taken to the Court of Appeal and possibly the House of Lords. For many years it has been the practice to incorporate in private Acts of local authorities and in Special Orders made in respect of trading departments of these authorities, a provision under which all receipts from all sources were to be paid into a Common Fund out of which all payments were to be made by the authority. This practice was further authorised by Section 185 of the Local Government Act, 1933, in so far as boroughs are concerned, and has subsequently been amplified by private legislation dealing with individual local authorities.

Such legislation frequently authorises payments to be made out of the general fund for specific purposes to the extent of credits to that fund from particular trading departments. Although it was, of course, necessary that separate accounts should be kept in respect of each trading department, showing at the end of each year whether a loss or profit had been made, this in no way interfered with the obligation to pool the receipts from each trading department in the Common Fund.

The Leeds Precedent

It was thought that the practice of maintaining, under statutory authority, a Common Fund was in accordance with the well known decision in the case of Sugden *v.* The Leeds Corporation, 1913, in which it was held by the House of Lords that for the purposes of income tax, local authorities could not pool the whole of their receipts unless specifically authorised so to do by statute, and that in every case it was necessary to have regard to the various public and local Acts which apply to the particular authority in question.

The Corporation of Leeds had not at that time any statutory authority authorising the formation of a Common Fund and, therefore, each trading department of the Corporation had to be regarded, for income tax purposes, as a separate entity and taxed upon the profits and gains of each department without regard to the financial position of other departments. As a result of this case it has become customary to insert provisions authorising the formation of a Common Fund in local authority legislation.

Losses and Gains

In his judgment in the South Shields case, Mr. Justice Lawrence stated clearly that the question depended upon the provisions of the private legislation applicable to the South Shields Corporation, and in particular of the South Shields Corporation Act, 1935, Sections 112–114. On the construction of these sections the learned judge held, in effect, that for taxation purposes, the loss upon one department of the Corporation could not be set off against a gain of another department.

There is little doubt that the provisions relating to the Common Fund contained in the South Shields Corporation Act are similar to, if not identical with, corresponding provisions in the Acts of other local authorities, and the decision, while dealing primarily with the liability of the South Shields Corporation to income tax, will have important bearings upon municipal trading throughout the country.

A Transatlantic Tribute

WE value very much indeed the opinion of our American friends the *Electrical World*, and were therefore greatly encouraged by the following note which appeared in the issue of September 6th:

"We salute our English contemporary, *Electrical Review*, which with its first issue in August went to a bantam size on account of the exigencies of wartime publication. *Electrical Review* has been typical of English technical publications in its resistance to change. Not only did it maintain the time-accepted size, but its format was the same. The reduced size has naturally brought some change in format.

"One gets the impression that while necessity caused a shrinkage of dimension, it did not otherwise alter the appearance of content. In fact, the announcement states that 'the total amount of editorial matter has not been reduced; the reduction is in the size of the advertisements.'

"When we looked through this first smaller-size issue we felt it represented something fine, something strong and firm. This seventy-year-old publication, the world's oldest electrical publication, while accepting the limitations of supply of such material things as paper, would not live in this smaller house with any less dignity or with less spiritual grace."

Air-Raid Damage

Lessons from Experience

By G. V. Harrap,
A.M.I.E.E., A.I.I.A.

The effects of high-explosive and incendiary bombs upon distribution equipment are studied and methods of protection and repair suggested

WHILE the following comments contain much that has been gathered from many sources, they relate, in the main, to the distribution side of an undertaking, in which damage to substations and mains has been considerable, serving an area where the destruction of residential property has been fairly extensive.

No further mention need be made of the vital necessity for holding considerable stocks of metalclad switchgear, transformers, high- and low-voltage cables, and lower-voltage fusegear. The purchase of these may put a strain upon the undertaking's finances, but if the stocks are well cared for, they will be good for use after the war, and their value will be all the greater when prices are high.

These cables, operating at 200, 2,000 and 6,600 V, continued to function although stretched over a bomb crater several feet wide

It has been remarkable how well modern metalclad switchgear has withstood the effects of high-explosive bombs dropped on to or alongside the buildings in which it is housed. Falling débris has been withstood best, in my experience, by gear incorporating fabricated structures rather than castings and having bakelised paper bushings instead of porcelain. Metalclad switchgear has also successfully stood up to fire, and only one instance is known of fire being caused by an electrical breakdown in the gear itself, and this was not serious. The most common cause of fire in air raids, with regard to electricity supply, is ignition of a timber framed, slated or tiled roof on a substation building. Here the disadvantage of having compound-filled busbars on the top of the gear becomes apparent.

With sheet-metal cubicle gear, blast plays havoc and usually results in more or less complete destruction. Porcelain insulators are shattered, and the switch-tank top, which is usually a casting in this type of gear, is often broken. Cubicle gear withstands the effect of fire remarkably well, especially if the top is covered with fire-resistant floor blocks. The latter were originally developed for building light walls and floors, and if used in slabs of 12 by 24 in., with a weight of 57 lb. per cu. ft., are very convenient. Such switchgear is easily dried out (preferably with electric radiators rather than blow lamps) but care is needed before putting it into service again. The most frequent trouble has been the fracture of porcelain insulators inside their clamps, caused either by heat or movement of the open-type busbars.

Curiously enough old transformers have often withstood bombing better than those of a more modern construction. The heavier form of tank and the more massive terminal gear have given good service in these times. These remarks are not to be taken as applying to the " turn "-type tank, with castings at top and bottom, which are found to be very vulnerable to both blast and fire. Those undertakings which have standardised weatherproof

gear, regardless of the situation of the transformer, have gained in air raids. Not only is it possible to move them about and install them in emergency without having to consider protection from the weather, but outdoor transformers have been found to withstand fire-hoses being directed upon and around them when burning material has fallen on them. Experience has shown that both transformers and switchgear have successfully withstood repeated electrical surges caused by faults and switching.

Cables and their joints after the impact of high-explosive bombs have continued to operate when bent to far sharper radii than the makers recommend, and when twisted and stretched and, maybe, lying in water with cracked lead sheaths. Cables, especially the high-voltage type, have stretched when on the edge of a crater, and have not parted their joints. Sometimes a cable has been forced a good distance out of its normal run and, in a few cases, joints of about 5 in. outside diameter have been pulled up 4-in. internal diameter ducts, and have still continued to function. It is debatable whether it is better to "snake" the cable, or cut out a section to get rid of the stretch; both have been done, but the latter is the more expensive as it needs a new joint. But "snaking" means drawing up a most curious record, so as to ensure finding the cable at a later date.

Cable Ducts and Diversions

Although many cables and joints have triumphantly withstood very severe treatment, and have perforce been left to carry on in these busy times, yet it is very possible that in years to come, faults will develop which can be directly attributed to this kind of damage. Some discussion has taken place upon the relative merits of building a new duct-line across a crater or making a diversion round it, when it is necessary to put a cable into service again before the crater has been filled and consolidated. Here, the actual circumstances often determine the method to be adopted, for in poor property districts, a bomb crater may extend from house to house, right across the road.

Then it becomes necessary to lay a new duct run, an example of which is shown on the bottom picture of p. 125 in the ELECTRICAL REVIEW, December 13th, 1940. On the same page are also illustrations of the way in which cables can be treated and still carry on. When a bomb falls at the base of a building and parts the cable in the pavement, the road is so littered with débris, that it is impossible to get at the damaged cable, and hence a diversion is necessary, of which an example is shown on the two illustrations on p. 126 of the same article.

While cold-filling compound is in itself very useful, it is not always appreciated that in making a joint, only a portion of the time is spent in jointing. First of all it is necessary for an engineer to find the fault, then for the jointer and mate to pull their truck to the site, after which the mate can prepare the compound while the jointer finds the broken ends, cuts back the cable until dry paper is located, takes delivery of a new length of cable to insert and then makes the joint. Even if an hour or two is saved by using cold-filling compound, what does the jointer do with the time saved, especially when it is considered that another day will have to be spent breaking down this joint and permanently remaking it?

Tenacious Overhead Lines

Overhead lines have stood up to the effect of high-explosive bomb blast very well. The fault, if any, is easily discernible, and can quickly be repaired. Even though sheds of porcelain insulators may be badly broken, it has been found that they will continue to give adequate service until renewals can be made.

The enormous acceleration in cable faults has shown the need for investigation of the value of earth electrodes. Although the voltage rise may be only small, yet the heavy currents which now flow with the large amount of fault power available, quickly cause burning of lead sheaths. It is therefore necessary, not only to drive in more earth pipes for the electrode itself (and pipes have been shown to be best where connection to a water main is not possible or permissible), but also to ensure that in all boxes, no cables touch one another, especially if they travel by different routes to the power station.

Protective systems have also stood up very well to air-raid conditions, and the non-pilot systems have shown that they are not to be scorned. In fact, with a proper system of grading, the simple inverse-time-limit overload induction relay has proved most reliable, on general high-voltage distribution networks. When a number of the substations include gear incorporating time-limit fuses, even if these be of different makes of wire, correct grading with the above type of relays can be obtained with a little thought and careful investigation, and correct discrimination secured.

Pilots and Relays

Where the protection depends upon pilots, constant testing is necessary to ensure that all cores of the pilot are still intact and that the relays will operate when required to do so. One disadvantage with normal relay cases is that they have glass fronts; this allows débris to enter the instrument, even if it does not cause unwanted operation, usually entailing removal of the relay for cleaning and overhaul. It is often the practice to set transformer high-voltage switch relays at a very small time multiple, and in some instances these

have tripped because of vibration from nearby bomb explosions.

Switchgear control wiring in generating stations has again shown its vulnerability. Segregation of the leads from the main cabling, and as much as possible from each other, is the keynote, and while this is probably hard to achieve in an existing installation, hundreds of yards of spare v.i.r. will be found an invaluable safeguard. No doubt this point will be taken care of in future designs, and it is likely that we shall not continue to perch a control room on top of an inflammable switch-house, where it would be the first thing to be hit. Neither will feeder cables be run out of the site *via* one route, but will be kept separate from those of the Central Electricity Board also.

Success of Emergency Gear

In speaking of the C.E.B., it is remarkable how well the emergency gear which was designed in the " old days " has gone together when required. The times for putting into commission have not perhaps been as spectacular as was at first thought possible, but then it certainly is a problem to erect switchgear, place transformers, and lay and joint super-voltage cable on a crater riddled site, littered with the remains of the original gear.

What might seem a very small point in the design of control rooms has had a marked effect upon operational efficiency; this is the matter of alarms. A good number of stations have a different toned bell for each type of fault operation, be it overload or earth-leakage protection, high-temperature alarm, etc. When things go wrong, the control room is filled with the ringing of many bells, and naturally this tends to confusion. An improvement has been made in eliminating all bells but one and in installing alongside each alarm-originating device (*e.g.*, overload relay) a flashing lamp. The resulting effect on the emotional behaviour of the operator is quite remarkable.

Building Construction

All buildings incorporating cement mortar have well repaid this additional expense in their ability to withstand shock and blast. Buildings have rarely fallen down through damage to the structure, although sometimes the walls are so badly broken that they have to be taken down and rebuilt. The weakest part of the structure, where there is a concrete roof, generally seems to lie at the damp-proof course.

Instances have been known where the whole building above the course has moved bodily for a distance of 2 to 3 in., without producing cracks or breakages in any other part of the structure. Where a building has a timbered framework roof, covered with slates or tiles, it is usual to find this is the weakest part of the structure. As a safeguard against fire risk, the woodwork can advantageously be treated with a fire-resistant finish of an A.R.P. grade.

Steel doors have generally proved themselves better than those made of wood, although in the larger sizes, there is not much to choose between them. Both types are usually blown off their runners, and although wooden doors may be splintered into small pieces, a new one is quickly made, whereas a steel door, if it be bent and buckled, is difficult to straighten or replace. All doors of a normal size usually have only one lock, probably of the night-latch type; these with their brass tongue and cast-iron keep are shattered in hundreds and a large stock of spares is essential if recourse is not to be made to wire and rope to hold the door closed.

Many substations have open transformer chambers, and it has been found invaluable to build hollow concrete walls in front of these. They can be made up from the standard hollow concrete or breeze blocks used for A.R.P. purposes, and should be filled with sand and cemented horizontally. The walls should be placed at such a distance from the building as to leave sufficient space for the removal of equipment if the need arises. In some cases, these walls have remained standing when the whole of the building has been demolished.

Pre-assembled Aerial Cable

WITH a view to reducing the cost of aerial cable, of which 121 circuit miles is now in use on its 5-kV distribution system, the Central Hudson Electric Corporation has developed a self-supporting cable which can be strung as a 1,000-ft. unit to include its catenary support. Particulars given in the *Electrical World* show the conductors to be insulated with oil-base rubber compound, surrounded by a semi-conducting tape over which is a bronze shielding tape as for the ordinary aerial cable, but without the weather-proof covering over each conductor. The cables are twisted together with a 42-in. lay, covered with sisal braid (no fillers being used) and wrapped to a Copperweld catenary by means of a soft-drawn flat copper tape, 0.04 by 0.30 in. with 8-in. spacing. When installing, a rope is fastened to the catenary and pulled to almost the correct sag through hinged blocks mounted on the pole. The top guard on the block is then opened and the copper binding tape removed for about 36 in. to enable the catenary to be slipped into a clamp. The cable is pulled up to its final sag by sighting.

This type of construction is said to have reduced the cost of installation by, from 25 to 40 per cent. In addition the assembled cable is less costly than the component parts of the conventional type of aerial cable and eliminates risk of whipping into other lines on the same pole. There is also a 75 per cent. decrease in the time that a linesman is needed on the pole. This method is utilised where tree-trimming costs are likely to exceed 80 per mile per year. Cable of this type has been installed with conductors up to No. 0 gauge.

COMMERCE and INDUSTRY

Training Sappers. Fuel-saving Campaign.

Fire Prevention Order

THE Electricity Commissioners have circulated to all authorised electricity supply undertakings a copy of the explanatory memorandum issued in connection with the Fire Prevention (Business Premises) (No. 2) Order, 1941, and have indicated at the same time the arrangements which apply particularly to the industry.

The Order provides for the reimbursement by the Exchequer of amounts expended by business organisations on subsistence allowances to fire watchers, and it is explained that electricity undertakers will be reimbursed through the Commissioners from whom the appropriate forms can be obtained. Upon return they must bear the signature of a responsible officer whose name must be notified to the Commissioners.

Economy is urged upon undertakings. The general intention is that the duration of turns of fire watching duty should normally be from eight to twelve hours; an unjustifiable expenditure of public funds would result from arrangements based upon unreasonably short terms of duty. Use should be made as far as possible during black-out hours of the services of such of the ordinary shift workers at generating stations and attended substations as could be spared temporarily from their normal duties for fire prevention if an emergency arose, in order to reduce the number of additional persons required to attend outside their normal working hours.

The Commissioners are in consultation with the Ministry of Home Security concerning the position of shift workers, key-men, emergency repair squads, etc., under the new Order, and the related Civil Defence (Compulsory Enrolment) Order. A further communication is to be addressed to electricity undertakers on these matters as soon as possible.

Training Engineers for the Army

The impression uppermost in the mind after visiting a trade training exhibition held recently at the Royal Engineers' School of Military Engineering, Trade Training Wing, Chatham, is the all-round knowledge that the present-day sapper has to acquire. Road and bridge construction (and destruction), the erection of buildings, the supply and maintenance of electricity for lighting and power, the provision of water supplies, and bomb disposal are just a few of the jobs that engineers in the Army may have to undertake, and the fundamental purpose of the training of every man, no matter what his trade, is to make him self-reliant, to render him capable of utilising facilities available for his work to their best advantage, in fact to improvise. Training is also based on the assumption that the work may have to be carried out in any part of the world.

The course provided by the Trade Training Wing lasts from four to six months according to the trade, and aims at raising Class III tradesmen to Class II standards. A Class III electrician, for example, is expected to be competent to deal only with two-wire systems ; in training him up to Class II standard he is taught three-phase work.

The other grades of electrician—linesman (power), electrician (power station) and electrician (maintenance)—as well as the instrument mechanic, welder, etc., all have their standard of knowledge stepped up similarly.

The trainees, who are from R.E. units stationed all over Great Britain and Northern Ireland and also from the Royal Canadian Engineers, have the satisfaction of knowing that, besides helping the war effort, they are improving their qualifications for securing good jobs in peace-time.

The "Cosmos" Calendar

The call of national economy has necessitated a smaller reproduction this year of the "Cosmos" Girl Calendar, but nevertheless the charming blonde who appears on the 1941-42 edition is a welcome addition to the long list of "Cosmos" girls who have preceded her.

The "Cosmos" Calendar for 1941-42

Aircraft Identification

Our contemporary *Flight* has produced a revised edition of its identification chart of German aircraft which includes several new types of machines employed by the Luftwaffe. Fifteen silhouettes and 44 line drawings with explanatory text make this chart of the utmost value to roof spotters and observers generally. It is obtainable from the Flight Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1, at 1s. 3d., plus 6d. postage for single copies, 7d. up to three copies and 8d. up to six copies.

Switchboard Attendants' Wages

The basic wages of switchboard attendants at generating stations of more than 100,000-kW capacity in the Greater London district have been increased by 1d. per hour and those of assistant attendants by ½d. The Industrial Court award giving these increases dates them back to April 8th.

Fuel Economy

We have already made some mention of the assistance which the British Electrical Development Association is giving the Mines Department in its endeavours to persuade the public to use less fuel, of whatever nature, and thus avoid the necessity of rationing. Further information has now been received, including a copy of a memorandum which has been circulated to all authorised electricity undertakings giving them advice on the distribution of leaflets prepared by the Mines Department and the Association and a declaration form which consumers are asked to

sign. With this there is a circular containing instructions to showroom and sales staffs upon their part in the campaign and advising them of the way to handle the consumer.

E.D.A. has also sent us examples of the advertisements which it has prepared in connection with the matter; these deal with economy in the use of electric cookers, fires and cookers in a practical manner.

Kettles and Saucepans

In order to make available a larger supply of kettles and saucepans the Board of Trade has issued a general licence (S.R. & O. 1941, No. 1586) permitting persons registered under Class 9 of the Limitation of Supplies (Miscellaneous) (No. 11) Order, 1941, to supply between now and November 30th, in addition to their quota for that class, kettles and saucepans not exceeding 5 per cent. of the total value of Class 9 goods supplied during the standard period June-November, 1939. A registered person may not, however, supply kettles and saucepans under this licence to a value exceeding £30 to any one person. Registered persons are required to keep a separate record of all kettles and saucepans supplied under the terms of this general licence.

Trade Announcement

The Jackson Electric Stove Co., Ltd., informs us that from Monday next its offices and showrooms will close at 5 p.m. instead of 5.30 p.m. as is now the case.

Window Protection

Regarding the Limitation of Supplies (Miscellaneous)(No.11) Order, 1941, window replacement and anti-scatter fabrics which could be supplied outside quota to factories subject to the Glass Protection Orders or against certificates signed by an Emergency Works Officer of the Ministry of Works and Buildings may now, under General Licence, S.R. & O. 1941, No. 1612, be supplied outside quota to any trader by persons registered for Class 4.

The Woolwich Appointment

It will be recalled that the Woolwich Borough Council recently advertised for a successor to the late Mr. F. F. Elliott as borough electrical engineer. The post was "banned" by the A.M.E.E.-E.P.E.A. Joint Committee on the ground that the salary offered (£1,500) was below the scale; the correct figure was said to be £1,768. Later fresh advertisements were published offering the higher amount.

At last week's meeting of the Council the matter was again discussed. It was alleged that the General Purposes Committee at an earlier meeting had said that the national agreement upon chief electrical engineers' salaries had been "duly registered both at the Board of Trade and at the Ministry of Labour as a properly registered agreement and is in force." The accuracy of this was questioned and it was admitted that while the agreement had been "deposited" with the two Departments mentioned there was no question of "registration."

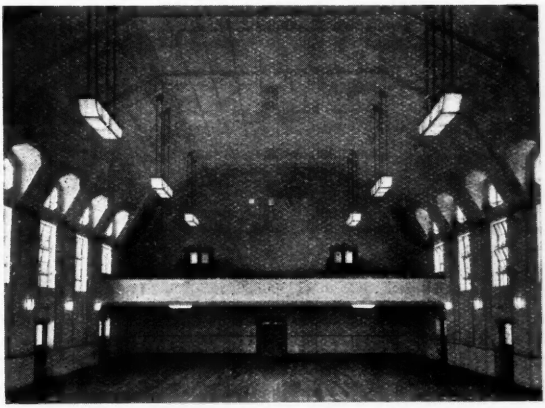
Fatality

On October 17th Mrs. Page, wife of the rector of West Wickham, Kent, received a fatal electric shock. It is reported that the accident occurred while she was adjusting black-out curtains at the Rectory.

A College Electrical Installation

The new Makerere College, Kampala, Uganda, is the first step towards a University in East Africa and has been built to open the doors of higher education to a greater number of Africans under the guidance of Mr. G. C. Turner, the late Principal of Marlborough College. It is the first establishment of its kind in Uganda and serves not only the populace of that province but also those of Kenya and other East African provinces.

The main administrative building is electrically equipped and the work has been carried out by the Public Works Department of Uganda under the supervision of Captain A. C. Willmott, C.B.E., Director of Public Works; Mr. C. T. Mitchell, F.R.I.B.A., the Government Architect; Mr. W. L. Whyte, A.M.I.E.E., A.Amer.I.E.E., Government Electrical Engineer and Inspector; Mr. F. U. M. Greer, engineer-in-charge; and Mr. P. C. Mowbray, works overseer. The local agents of the General Electric Co., Ltd., Gailey and Roberts (Uganda), Ltd., supplied the general fittings and cable, but the special lighting fittings were supplied by the G.E.C.



The assembly hall and theatre at Makerere College, Kampala, Uganda, lighted by G.E.C. fittings

The four storeys of the main building are served by a four-passenger "Express" S.M.S. automatic push-button lift. This is designed for three-phase, 50-cycle, 415-V supply, the control panel being fitted with a reverse phase relay. Although some of the lighting fittings, including the two wrought-iron lanterns at the main entrance were specially designed to conform aesthetically with the furnishings and surroundings generally, the majority of the fittings employed are standard

designs chosen from the G.E.C. range. Some are decorative and others are of the plainer utility type. In the assembly hall (shown in the accompanying illustration) the ceiling and wall fittings installed had necessarily to be of a type which would preclude the ingress of insects which would otherwise affect the efficiency of the lighting. Those shown successfully achieve this object and at the same time are decorative and well suited to the surrounding architecture. Each is fitted with a "Gecoray" reflector for projecting light in an upward direction, and auxiliary lighting which is diffused through translucent glass panels provides direct illumination. The assembly hall also serves as a theatre and includes a stage with full lighting equipment —footlights, side and spotlights, etc.—which are controlled from a central panel giving the necessary mixing and dimming effects.

Above the central tower of the building a red warning light, operated by a selenium cell relay, is installed. This is a necessary precaution since Makerere Hill on which the college stands adds considerably to the effective height of the building and is in fairly close proximity to Kampala aerodrome and the flying boat landing station. The whole of the electrical equipment has been installed by Indian electricians assisted by African labour.

Patents and the War

In the House of Commons last week Sir Andrew Duncan, President of the Board of Trade, stated that he hoped shortly to introduce legislation to facilitate the obtaining of extensions of the term of their patents by patentees who had suffered loss or damage by reason of the war.

Membership of N.J.I.C.

After considering a letter from the secretary of the District J.I.C., the Retford Electricity Committee has recommended that the Corporation shall become a member of the National Joint Industrial Council for the Electricity Supply Industry. Membership of the same body, and also of the National Joint Board of Employers and Staff Members for the Electricity Supply Industry, has been approved by the Dumfries County Council.

Grampian Company Fined

A fine of £50 was imposed by Sheriff Valentine at Perth Sheriff Court on October 10th on the Grampian Electricity Supply Co., 10, Melville Street, Edinburgh, who admitted that when work had to be done at a switchboard on April 8th it was not made dead, in consequence of which Daniel Vincent Flanagan sustained injury and died two days later.

For the company an agent said that urgent alterations had to be made to the switchboard and at the same time it was essential to keep the supply of electricity going. The company arranged that half of the switchboard was to be made dead while the other half—the north bay—was to remain in operation. Deceased touched a live terminal just inside the north bay.

The Sheriff asked whether some sort of fence could not have been put up and the agent replied that after the accident a fence was provided.

The prosecutor explained that Flanagan was instructed to do certain work in the south bay. After a while he needed more tools and, proceeding to get them, had gone only a short distance when he came in contact with the live wire. There should have been a permanent separation and it was the duty of the company to see to the safety of the workmen.

Sequel to Buffing Machine Fatality

At the Sheriff Court Hamilton, on October 7th the Clyde Alloy Steel Co., Ltd., was charged with a contravention of the Electricity Regulations, 1908, in respect that adequate precautions were not taken either by earthing or by other suitable means to prevent the metal work of an electric buffing machine in the heat treatment department from becoming electrically charged, in consequence of which a workman received an electric shock and died. The company pleaded not guilty.

Mr. John M. Jones, an electrical inspector of factories, who visited the works and examined the buffing machine which deceased had been working at the time of the accident, gave evidence in support of the charge.

On behalf of defendants it was stated they carried out their electrical installations with very great care. One of their employees, an electrician, stated that he had been with a number of firms, and none of the others had as high a standard as regards safety, Witnesses also stated that, owing to circumstances beyond its control, the company had many difficulties to contend with in May last.

Sheriff Walker, who found the charge proved, expressed sympathy with respondents in the circumstances, and imposed the modified penalty of £12 12s., with £4 8s. 6d. costs.

Oil Washing Plant

Under the Machinery, Plant and Appliances (Control) (No. 5) Order, 1941 (S.R. & O. 1941 No. 1610, price 1d.) dated October 13th, lubricating oil washing machinery and plant has been added to the schedule of goods the supply of which is subject to Board of Trade licence. Application forms for licences should be obtained from the Industrial Supplies Department (Machinery Licences Division), Board of Trade, 1-6, Tavistock Square, London, W.C.1.

Change of Address

Houchin, Ltd., installation contractors, have moved to 42, Stanley Street, Liverpool (telephone: Advance 2783).

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

Ross anti-vibration discs for b.c. lamp-holders.

ELECTRICITY SUPPLY

Dumfries Rural Electrification. Position of Penarth Area.

Blyth.—PLEA FOR MODIFIED LIGHTING.—The Town Council is to make representations to the Government to allow some form of subdued street lighting during the winter months.

Bradford.—H.V. CABLE.—The Electricity Committee is to lay a high-voltage cable at a cost of £2,427.

Cardiff.—PENARTH SUPPLY.—Recently application was made to the Electricity Commissioners for permission to proceed with the Special Order to incorporate Penarth within the area of supply of the Corporation. In reply the Commissioners stated that, having regard to the necessity for conserving financial and material resources to the maximum possible extent for war purposes, they did not consider that the submissions put forward justified the promotion of the proposed Special Order, but they intimated they would be prepared to discuss the position with representatives of the Corporation. The town clerk has been asked to make preliminary inquiries as to the suggested interview with the Commissioners.

Dumfries.—ELECTRICITY CHARGES.—The Town Council at its last meeting adopted the burgh electrical engineer's recommendation that the suggested increase in the two-part tariff should not be enforced in view of the Government circular asking that charges should not be increased except in exceptional circumstances. The burgh treasurer contended that it was not right for any loss to be made good from the Council's own reserve fund, which had been got together by the Electricity Department at a time when the present arrangement was not in existence. It could be said definitely that there was no reason to raise charges because of any increase in expenditure or decrease of output on the part of the Department itself. It was therefore due to the cost of electricity. He did not see why the Central Electricity Board or the Electricity Commissioners should not apply their reserves to meet the burgh's loss.

Dumfriesshire.—TEN THOUSAND CONSUMERS.—At a recent meeting of the County Council, Mr. W. M. Bell-Macdonald, convener of the Electricity Committee, announced that the Department had now linked up its 10,000th consumer. A great deal of credit was due, he said, to the county electrical engineer, Mr. J. S. Pickles, and his staff. Incidentally, on the staff there were six members who were in the employment of the Committee at the start of the scheme. Much of the success achieved was due to the fact that they had never in the past asked for a contribution from anyone towards the cost of putting electricity into houses.

Felling-on-Tyne. — SHELTER LIGHTING. — The Education Committee has received consent to borrow £598 for lighting school shelters.

Hexham.—NO LIGHTING.—On the recommendation of the Works Committee the Urban District Council has decided to take no action regarding the introduction of "starlighting."

Ilkley.—SUPPLY TO SANATORIUM.—The West Riding County Council has approved a 10 years' agreement with the U.D.C. for the electricity supply to the Middleton-in-Wharfedale Sanatorium, subject to revision in 1944 and 1947. The terms are that the U.D.C. shall supply electricity up to a maximum load of 150 kVA. the County Council to pay £4 4s. per kVA of maximum demand per year ending March 31st, plus ¾d. per kWh (subject to variation in the cost of coal as provided in the existing agreement), and a meter rent of £6 per annum.

Leek.—LOANS.—The Urban District Council is applying for sanction to borrow £1,010 for plant and £1,400 for meters.

Liverpool.—CONTROL OF STREET LIGHTING.—Explaining why it was impracticable to employ a master switch to permit the relaxation of lighting restrictions, Mr. P. J. Robinson, city electrical engineer, stated that of the 33,000 street lamps in the city approximately 18,000 were electric and the remainder gas. Only about 5,000 electric lamps were under one control switch. Before the war the Department was gradually working towards master control for all electric street lighting, but the war stopped those efforts. If the pre-raid lighting restrictions were lifted, it was just possible that bombs might switch on lights during an alert and cause danger to everyone living in the area. Every electric bulb had been removed from street lamps as a precaution.

Northern Ireland.—PRICE INCREASE.—At the monthly meeting of the Carrickfergus Urban Council the electrical engineer, Mr. G. C. Wakelam, reported that a loss of over £1,000 had been incurred on the undertaking last year. He suggested that in view of the increased price of coal 10 per cent. should be added to consumers' accounts. This was agreed to, subject to the approval of the Ministry of Commerce.

Retford.—MODIFIED LIGHTING.—The Council is considering the provision of modified lighting.

Shipley.—LOAN.—The Electricity Committee has obtained sanction to borrow £2,000 for mains and services.

Swindon.—SUBSTATION PROTECTION.—The Electricity Committee is to provide protection at a substation at a cost of £1,625.

Thornley (Co. Durham).—MODIFIED LIGHTING.—The Council is to investigate the possibility of introducing some form of modified street lighting.

Minimum Charges

IN the House of Commons last week Major Lyons asked the President of the Board of Trade whether, in view of the need for conservation of fuel and light, he would consider the withdrawal of minimum charges for lighting, whether by gas or electricity, where now obtaining, and so encourage economy by substituting actual consumption charges in every case.

Captain Waterhouse said that gas undertakings were not given statutory authority to make minimum charges. Electricity undertakings which, unlike gas, had to install plant to cover their peak load and to maintain it for use when required, were authorised to make minimum charges, and it was not unreasonable that they should continue to be made.

Torquay.—LOANS.—The Electricity Committee is seeking sanction to borrow £2,500 for meters and £2,000 for consumers' apparatus.

Wakefield. — EQUIPMENT FOR TECHNICAL COLLEGE.—The Education Committee has obtained sanction to acquire electrical and other equipment for the technical college at an estimated cost of £1,099.

POWER TARIFF INCREASE.—The price of electricity to large power consumers subject to operation of a coal clause is being increased by 7 points (0.07d.) per kWh. In the case of other industrial power consumers there is to be an increase of 10 per cent. in the basic price.

Winchester.—UNDERTAKING'S PROGRESS.—Reporting to the Council on the year's working of the Electricity Department, Alderman Johnson, chairman of the Electricity Committee, said that the period under review had been full of problems, but thanks to the successful management and the loyal services of the whole staff, a record had been established both in output and in general development. There was a surplus which had been carried forward to the appropriation account. The undertaking had issued on hire during the year 563 cookers, 574 kettles, 130 wash boilers, 161 water-heaters, and 18 refrigerators, so they were making a satisfactory contribution, he thought, to the domestic life of Winchester.

Overseas

Eire.—GAS RATIONED.—Because of the shortage of coal, gas rationing has been introduced at Cork and Clonmel. At Cork the gas supply is restricted during the week to the following periods: 7.30 a.m. to 2 p.m. and 6 p.m. to 9 p.m. On Sundays the hours are 8 a.m. to 10 a.m., noon to 2 p.m. and 6 p.m. to 9.30 p.m. At Clonmel the supply is being cut off between 9.30 a.m. and 2 p.m.; it was stated at a meeting of the Gas Committee that it might be necessary to close the gasworks altogether.

India.—LIST OF ESSENTIAL SUPPLIES.—Measures for maintaining the electricity supply in Calcutta and the surrounding industrial areas if damage is caused by enemy action to generating stations, cables, distribution mains, etc., has recently been under consideration by the Bengal Government. It is proposed to compile a list of consumers to whom an electricity supply is essential.

United States.—OUTPUT UP 18 PER CENT.—Electric power produced for public use in July totalled 13,999 million kWh, an increase of 18.1 per cent. on July, 1940, according to the latest report of the Federal Power Commission.—*Reuter's Trade Service.*

TRANSPORT

London.—WINTER PLANS.—The London Passenger Transport Board has now completed its plans for the winter. The experience of operation under wartime conditions gained last winter has been closely examined in relation to the many changes in numbers and the location of workers which have taken place since that time, and the lessons learned are reflected in the winter programme, which is being introduced this month. Workers at war factories will receive first consideration in the winter schedules. A substantial contribution to the more efficient transport of factory workers will be afforded by the scheme initiated by the London & South Eastern Regional Board of the Production Executive, in collaboration with the L.P.T.B., for the staggering of working hours. More than 400,000 workers, it is estimated, will benefit by the scheme, the basis of which is the readjustment, by 15-minute intervals, of the times of beginning and ending work. Passengers holding the return halves of cheap day railway tickets will not be permitted to travel from London between 4.30 and 6.30 p.m. (Mondays to Fridays). To compensate for the reduction of road services in the black-out and to provide transport between the main-line terminals, services on all Underground lines will be more frequent at night than they were last winter, when it was found that the Underground was the most attractive form of travel in the black-out.

COMPOSITE CARRIAGE.—In the autumn of last year two carriages of District Railway trains were badly damaged by enemy action, but one end of each was not seriously affected. The wrecked end of one car was cut off and all members, including the solebars and main longitudinals, were cut through on a vertical plane running just inside the first pair of double doors. The other car was similarly cut so that when the two portions were butted together all members could be joined by welding without make-up pieces. One serviceable car was thus obtained with the aid of very little new material.

Northern Ireland. — BELFAST TROLLEY-BUSES.—In consequence of the impending changeover from trams to trolley-buses in the eastern section of the city a rearrangement of the tram routes will come into operation on October 30th. The change to trolley-bus operation, however, may not take place until the New Year.

MINIMISING FLASHES.—Trams returning from Belfast city centre to their depots at night will in future not be reversed, but will circle the city to reach their destinations, as the manipulation of the trolley poles in reversing causes vivid flashing. In a further endeavour to eliminate this danger, wire finders are being placed at each of the termini. This device takes the form of a lighted trough 6 to 8 ft. in length suspended above the wires. One is already in position at the Balmoral terminus and is operating satisfactorily. The most serious part of the problem lies in the numerous crossings, points, etc., in the centre of the city. These are being "white lined" to indicate that drivers are to switch off power. Where it is not possible to coast over the flash point, shields are being put in position to deflect the flash downwards.

Salford.—TRAFFIC SIGNAL EXPERIMENT.—In order to make traffic signals more visible during daylight the Corporation is experimenting with a spot of white light at the point where the arms of the red, amber and green crosses intersect to indicate which disc is in operation.

RADIO & TELEPHONY

Great Britain.—RADIO RELAY STATISTICS.—At June 30th, there were 326,385 subscribers to 280 radio relay exchanges, compared with 314,906 subscribers to 282 exchanges at March 31st.

Italy.—MARCONI MAUSOLEUM.—It is reported from Rome that the body of Marchese Marconi was recently taken from the family vault to a special mausoleum which has been erected at Pontecchio. Mussolini was present at the ceremony which was conducted by the Archbishop of Bologna.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Young Accumulator Co., Ltd., reports a trading profit for the year to March 31st of £20,956 as compared with £19,381 for the preceding year, to which is added transfer fees of £22 making £20,978. Depreciation requires £3,446, repairs and renewals £1,422, interest £1,375, directors' fees £1,300, staff endowment £445, and A.R.P. £881, leaving a balance of £12,108. After providing for tax there is a net profit of £5,333 (against £10,397). It is not proposed to pay any dividend (against 5 per cent., less tax, in the previous year) and after writing off various expenses, etc., the balance carried forward is £5,712 (against £5,431 brought in).

Crompton Parkinson Ltd. have offered to purchase the whole of the £193,479 issued capital of the Young Accumulator Co. at 2s. 3d. per 2s. share. The price will be payable as to 11d. in cash, plus 1s. 4d. in shares on the basis of one Crompton Parkinson 5s. "A" ordinary share for every fifteen Young Accumulator 2s. shares. The offer is the result of recent negotiations by the Young Accumulator Co. for a merger with Crompton Parkinson, and a conditional merger contract embodying the offer has been entered into between the two companies.

The directors of the Young Accumulator Co. state in a circular to shareholders that the merger is conditional on the contract being ratified by 90 per cent. (or any less amount that Crompton Parkinson may agree) of the Young Co.'s issued shares by November 6th next (or any extended date agreed by both companies). Crompton's have also offered to buy at 5s. each the issued £1 shares of the Young Accumulator Co.'s subsidiary, Associated Electric Vehicle Manufacturers, Ltd., held otherwise than by the Young Co.

Falk, Stadelmann & Co., Ltd., report a trading profit for the year ended March 31st of £124,845, as compared with £97,602 for 1939–40. After deducting income tax £33,937, N.D.C. £4,650 and staff pensions £6,350, the net balance is £79,908, plus a writing back of £2,474 from reserve no longer required in respect of the decrease in value of securities. The net profit for the previous year was £76,017. The ordinary dividend for the year is 7½ per cent. (against 7 per cent.) and the balance carried forward is £40,376 (against £32,807 brought in).

A. C. Cossor, Ltd.—Presiding at the annual meeting held on October 16th, Sir Louis Sterling (chairman and managing director) said that although their activities and those of their subsidiaries had expanded very considerably, resulting in an increase in the trading profit of over £20,000, the net balance available amounted to £94,701 as against a sum of £99,294 for the previous year. While their pre-war standard of profits was such that they were again immune from Excess Profits Tax, the shareholders would appreciate that under war conditions a reduced margin of profit might be expected. All their works were fully occupied and the directors were taking every step to preserve the goodwill of the business. Their two operating subsidiary companies had traded satisfactorily and, as pointed out in the report, the full benefits of the reorganisation of the Sterling Cable Co. had been felt for the first time during the year.

The Electrolytic Zinc Co. of Australasia reports a profit for the year to June 30th, before deducting tax and additional war contingencies, of £707,784, an increase of £95,606 as compared with 1939-40. The net profit is £362,784, a decrease of £85,998. The dividends paid totalled 14 per cent., the same rate as for the preceding year, on the preference and ordinary shares. The £400,000 ordinary shares issued in June last to finance plant extensions do not participate in the year's dividend.

The Telephone Co. of Pernambuco reports an increase in operating revenue from 2,433 contos in 1939 to 2,454 contos in 1940. The net operating revenue in sterling is equivalent to £2,717 and surplus earnings at the rate of exchange prevailing at December 31st last amount to £6,326. These have been set aside for meeting interest and redemption of the 8 per cent. registered debentures when exchange is available.

The Montreal Tramways Co.—According to the *Financial Times* a scheme of arrangement is to be submitted at a meeting of holders of first and refunding mortgage 5 per cent. 30-year gold bonds and general and refunding mortgage sinking fund gold bonds, series "A" to "D" to be held in Montreal on December 9th and 10th.

The Southern Areas Electric Corporation, Ltd., has informed shareholders that the payment of an interim dividend has been under consideration and while the position to date might justify such a payment it is in their best interests to await the final results before determining the dividend distribution for the year.

The Britannia Electric Lamp Works, Ltd., reports a profit of £31,802 for the year ended April 30th last, as compared with £37,405 in 1939-40. After making provision for taxation, etc., a dividend of 7 per cent. is again being paid and £11,032 (against £10,951) is carried forward.

Ferranti, Ltd., report an increase in net profit from £78,159 for 1939–40 to £79,282 for 1940–41. The dividend is maintained at 6 per cent. free of tax.

The Electrical Finance & Securities Co., Ltd.—An interim dividend of 4 per cent. is being paid on the ordinary shares, as last year.

The Telephone & General Trust, Ltd., has announced an unchanged interim dividend of 3 per cent.

The Skefko Ball Bearing Co., Ltd., has declared an interim dividend of 6⅔ per cent., tax free (unchanged).

Babcock & Wilcox, Ltd., are again paying an interim dividend of 4 per cent.

The British Thermostat Co., Ltd., has declared an interim dividend of 7½ per cent. (unchanged).

The Anglo-American Telegraph Co., Ltd., is paying a quarterly dividend of ¾ per cent. (against

$2\frac{1}{2}$ per cent. for the corresponding quarter of last year).

The Woking Electric Supply Co., Ltd., is again paying an interim dividend of 3 per cent., tax free.

New Companies

Vitex Electrical, Ltd.—Private company. Registered October 9th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, dry batteries and electrical goods and appliances, etc. Directors: L. Fabian, 23/24, Bark Place, W.2, and M. Skirlnick, 83, Wellesley Court, Maida Vale, W.9. Registered office: 24, Bark Place, Bayswater, W.2.

W. J. Mathews (Exeter), Ltd.—Private company. Registered October 8th. Capital, £1,000. Objects: To carry on the business of electrical, lighting, wireless, television and general engineers, service agents, etc. Mrs. Ada Mathews, Brooklyn, Topsham Road, Countess Wear, Exeter, is the permanent managing director. Registered office: 33, Commercial Road, Exeter, Devon.

Robert Springer, Ltd. — Private company. Registered October 10th. Capital, £1,500. Objects: To acquire the business of an electrical contractor carried on by Robert Springer at 253, Plymouth Grove, Manchester, 13. Directors: R. Springer and J. Springer, both of 4, Motcombe Road, Gatley, Cheshire, and M. Springer, 1, Florence Avenue, Warton, Lytham St. Annes. Registered office: 253, Plymouth Grove, Manchester, 13.

Searchlight Batteries (Lancs), Ltd.—Private company. Registered October 11th. Capital, £1,000. Objects: To carry on the business of wireless, mechanical and general engineers, manufacturers of, and dealers in, dry batteries and accessories, etc. Directors: J. C. North, 88, Appleby Lodge, Wilmslow, Manchester, N. Nelson, "Amstel," Park Road, Manchester, L. Seifert, Bassett Road, Kensington, W., and B. Seifert, 84, Franklyn Gardens, Edgware, Middlesex. Solicitors: Osmond, Bard and Co., 14/18, High Holborn, W.C.1.

Cavell Batteries, Ltd. — Private company. Registered October 11th. Capital, £400. Objects: To carry on the business of electricians, engineers, manufacturers of, and dealers in, torches, batteries and accumulators, etc. Subscribers: M. L. Allen, 62, Welham Road, S.W.17, and E. E. Hall, 24, Arundel Gardens, Burnt Oak, Edgware. Registered office: 31, King's Road, Sloane Square, S.W.3.

Companies' Returns

Statements of Capital

Folkestone Electricity Supply Co., Ltd.—Capital, £237,500 in 50,000 5 per cent. cumulative preference, 175,000 ordinary and 12,500 employees' co-partnership shares, all of £1. Return dated April 8th. All shares taken up. £200,000 paid on 140,000 ordinary, 50,000 preference and 10,000 employees' shares. £37,500 considered as paid on the remainder. Mortgages and charges: Nil.

Lighting Accessories, Ltd.—Capital, £250 in 250 shares of £1 each. Return dated May 16th. All shares taken up. £2 paid. £248 considered as paid. Mortgages and charges: Nil.

W. H. Porter & Co., Ltd.—Capital, £100 in 100 shares of £1 each. Return dated May 12th. 90 shares taken up. £90 paid. Mortgages and charges: £2,000.

Western Electric Co., Ltd.—Capital, £20,000 in £1 shares. Return dated May 27th, 1941. All shares taken up. £20,000 paid. Mortgages and charges: Nil.

Electrical & Steam Appliances, Ltd.—Capital, £100 in £1 shares. Return dated January 12th, 1941 (filed June 4th, 1941). 2 shares taken up. £2 paid. Mortgages and charges: Nil.

United Telephone Cables, Ltd.—Capital, £1,000 in 1,000 shares of £1 each. Return dated May 29th, 1941 (filed June 9th, 1941). All shares taken up. £1,000 paid. Mortgages and charges: Nil.

Harry Astbury, Ltd.—Capital, £1,000 in £1 shares. Return dated April 30th (filed June 13th). 366 shares taken up. £366 paid. Mortgages and charges : Nil.

Eastern Telegraph Co., Ltd.—Capital, £40,000 in 40,000 shares of £1 each. Return dated July 10th. All shares taken up. £40,000 paid. Mortgages and charges: Nil.

Direct West India Cable Co., Ltd.—Capital, £200,000 in 200,000 shares of £1 each. Return dated July 10th. All shares taken up. £200,000 paid. Mortgages and charges: Nil.

Dawlish Electric Light & Power Co., Ltd.—Capital, £40,000 in 40,000 ordinary shares of £1 each. Return dated July 10th. All shares taken up. £40,000 paid. Mortgages and charges: Nil.

Cable & Wireless, Ltd.—Capital, £30,000,000 in £1 shares. Return dated July 10th. All shares taken up. £1,266,493 paid. £28,733,507 considered as paid. Mortgages and charges: Nil.

Western Telegraph Co., Ltd. — Capital, £3,500,000 in £3,118,950 ordinary stock and 38,105 shares of £10 each. Return dated July 11th. £3,118,950 stock taken up. £2,339,650 paid. £779,300 considered as paid. Mortgages and charges: £818,675.

Mortgages and Charges

Peto Scott Electrical Instruments (Holdings), Ltd.—Mortgages on proceeds of contract, dated September 17th, 1941, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

S.E.G., Ltd.—Mortgage dated September 16th, 1941, to secure all moneys due or to become due from the company to National Provincial Bank, Ltd., charged on freehold property at Heston and Isleworth.

Underwood (Electric), Ltd.—Assignment on October 1st, 1941, of proceeds of certain contracts, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £14,000 at any time. Assignment on September 24th, 1941, of proceeds of contracts, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £2,500 at any time.

Liquidations

Dome Electric Co., Ltd.—Particulars of claims by November 20th, to the liquidator, Mr. A. J. Eaves, 47, Mosley Street, Manchester.

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange conditions, markets and prices, have been governed during the past few business days by the nature of the news from Moscow. Each bulletin has been awaited with anxious interest, more members of the House now lingering to hear the one o'clock broadcast circulated through the Stock Exchange, than ever before. The pressure upon the Russian defenders of their city has aroused profound sympathy in Stock Exchange, as in all other circles.

From the material point of view, prices have changed comparatively little. There has been a lessening of support for industrial investments and in the purely gilt-edged departments the sentiment is rather less firm than it has been of late. Prices nevertheless keep steady. This week's changes amongst stocks and shares quoted in our lists exhibit no special feature.

Changes in Prices

A fall of 10 points to 875 in British Electric Traction deferred stock represents no more than the fact that the stock is at the moment easier to buy than to sell. The market is following the lead set by Home Railway stocks, which is distinctly heavy. Southern Railway preferred, at 60¼, is 1 down. The preference, however, keeps its price at 98½. In the Cable and Wireless group, the 5½ per cent. preference stock went back to 102 ex dividend, before recovering a point. The ordinary stock at 65 is 10s. up on the week. Marconi Marines strengthened to 27s. 6d. No changes of importance have occurred in the Home electricity supply market. Overseas companies' shares are equally placid. The dollar stocks are lower, and Tokyo sixes show a point fall. Atlas Electric shed a few pence to 2s. 9d.

"Emmies"

Automatic Telephone shares at 48s. 9d. and Chloride Electrical Storage at 70s. are both ⅛ better. Greenwood & Batley rose a further 1s. 9d. to 25s., at which the price still shows the high yield of £10 8s. 0d. per cent. on the money. The only change worth mentioning in equipment shares is a rise of ⅛ to 22s. 6d. in Henley's. Electric & Musical Industries—"Emmies" for short—have been a fairly active market round about 12s. 6d. If the recently-declared dividend of 6 per cent. is continued, the yield, at the present price, will be £4 16s. 0d. per cent. Money invested in the shares is not, to use a colloquial phrase, eating its head off. British Thermostat ordinary shares are unchanged at 13s. 9d. on announcement of the interim dividend of 7½ per cent.—the same as that of a year ago. Southern Areas Electric is again paying no interim dividend. Last year there was 5 per cent. at the end of the year. Ward & Goldstone have hardened to 17s. 6d.

Transport "C"

London Passenger Transport "C" stock has gone back to 40, showing a point fall. This follows upon declines which have been taking place since the price rose to 46 at the end of August last. As pointed out here at the time, the yield offered by Transport "C" on its 3 per cent. dividend, and at its then price, looked meagre by comparison with the return afforded by various other low-priced Home Railway stocks. The prices of the latter have also been dwindling and Transport "C" followed the market suit. At 40 the return is 7½ per cent. on the money, which is still below that obtainable from other Home Railway stocks which look equally secured but which, on the other hand, have not the same degree of scope for post-war improvement as Transport "C" stock offers. It is this consideration which keeps up the price. The quotation moves, however, in correspondence with the tendency of the Home Railway market as a whole. Two of the Board's prior-charges, the 4½ per cent. "A" and the 5 per cent. "B," have both advanced to 114½.

Electricity Supply Ordinary

The continued uncertainty that prevails in connection with the Government's intention with regard to the war damage liability that is to be shouldered partially by the Government and partially by the utility companies, holds no terror for the proprietors of electricity supply shares, the prices of which continue to be maintained as firmly as ever. Amongst the ordinary shares which are on offer at the present time the following appear in a list issued by the Stock Exchange firm of dealers in that market. It will be noticed that the returns are modest, ranging from four guineas per cent. on Clyde Valley, to £4 16s. 6d. per cent. on North Somerset. The prices and last-paid dividends are as follows:—

Ordinary Shares	Price s.	d.	Div. %	Yield. £	s.	d.
Clyde Valley ..	38	0	8	4	4	6
Lancashire ..	33	6	7½	4	9	7
Mid. Counties ..	38	3	8	4	4	0
Mid. Cheshire ..	35	0	8	4	11	5
Mid. Elec. Corpn.	40	0	9	4	10	0
North Somerset ..	29	0	7	4	16	7
West Gloucester ..	20	0	4½	4	10	0

There are also 2,000 Calcutta Electrics obtainable at 38s. The company last paid a dividend of 7 per cent. free of tax.

Industrials on Offer

One thousand General Electrics are obtainable at 77s. 9d., which, on the last-paid dividend of 17½ per cent., gives a return of a few pence over 4½ per cent. Crompton Parkinson 5s. "A" shares can be bought as to a few thousand shares at 20s. 6d. The company paid 20 per cent. last year and at the price quoted the yield is £4 17s. 6d. There has been inquiry for Revo

(*Continued on page* 453)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Oct. 21	Rise or Fall	Yield p.c.
Home Electricity Companies					£ s. d.
Bournemouth and Poole	15	12½	52/6	..	4 15 5
British Power and Light	7	6	26/–	..	4 12 4
City of London	7½	7	25/9	..	5 8 9
Clyde Valley	8	8	37/6	..	4 5 4
County of London	10½	8	35/–	..	4 11 5
Edmundson's:					
7% Pref.	7	7	32/6	..	4 6 2
Ord.	6	6	28/–	..	4 5 9
Elec. Dis. Yorkshire	9	9	40/9	..	4 8 3
Elec. Fin. and Securities	12½	12½	43/9	..	5 14 2
Elec. Supply Corporation	11½	10	43/9	..	4 11 4
Isle of Thanet	2	Nil	9/–	..	—
Lancs Light and Power	7½	7½	33/9	..	4 9 0
Llanelly Elec.	5½	5½	21/6	..	5 2 4
Lond. Assoc. Electric	5½	4½	18/9	–9d.	4 16 0
London Electric	7	7	24/6	..	5 14 3
London Power Deb. Red.	5	5	103	..	4 17 2
Metropolitan	10	8	36/3	..	4 8 5
Midland Counties	8	8	38/3	..	4 3 4
Mid. Elec. Power	9	9	38/9	+6d.	4 13 0
Newcastle Elec.	7	7	27/6	..	5 1 10
North Eastern Elec.:					
Ordinary	7	7	29/6	..	4 15 0
7% Pref.	7	7	32/6	..	4 6 2
Northampton	10	10	44/6	..	4 10 0
Notting Hill 6% Pref. (£10)	6	6	8½	..	—
Northmet Power:					
Ordinary	10	7	35/–	–6d.	4 0 0
6% Pref.	6	6	29/6xd	..	4 1 4
Richmond Elec.	6	6	22/6	..	5 6 8
Scottish Power	8	8	38/3	..	4 3 4
Southern Areas	5	5	18/3	..	5 9 7
South London	7	7	23/6	..	5 19 2
West Devon	5	5	21/3	..	4 14 1
West Glos.	4½	4½	19/6	..	4 12 4
Yorkshire Elec.	8	8	39/6	..	4 1 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	2/9	–3d.	—
Calcutta Elec.	8*	7*	37/–xd.	..	—
Cawnpore Elec.	10	10	28/9	..	6 19 0
East African Power	7	7	25/9	..	5 8 9
Jerusalem Elec.	7	5	17/6	..	5 14 3
Kalgoorlie (10/–)	7½	7½	13/–	..	5 15 5
Madras Elec.	6*	4*	22/6	..	3 11 1
Montreal Power	1½	1½	25½	–1	5 13 2
Palestine Elec. "A"	Nil	Nil	17/6	..	—
Perak Hydro-elec.	2½	6	19/6	..	6 3 0
Shawinigan Power	83cts.	90cts.	16½	–½	—
Tokyo Elec. 6%	6	6	35½	–1	16 18 0
Victoria Falls Power	15	15	78/9	..	3 16 2
Whitehall Inv. Pref.	7½	7½	15/–	..	10 0 0

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Oct. 21	Rise or Fall	Yield p.c.
Public Boards					£ s. d.
Central Electricity:					
1950–70	5	5	110	..	4 11 1
1955–75	5	5	113	..	4 8 6
1951–73	4½	4½	107	..	4 4 1
1963–93	3½	3½	101	..	3 9 4
1974–94	3½	3½	94	..	3 9 2
London Elec. Trans. Ltd.	2½	2½	95	..	2 12 8
London & Home Counties 1955–75	4½	4½	106½	..	4 4 6
Lond. Pass. Trans.:					
A	4½	4½	114½	+1	3 18 7
B	5	5	114½	+1	4 7 4
C	1½	3	40	–1	7 10 0
West Midlands J.E.A. 1948–68	5	5	108½	..	4 12 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	107½	..	5 11 9
Def.	1½	1½	24½	..	6 2 5
Anglo-Portuguese	8	8	15/–	..	10 13 4
Cable & Wireless:					
5½% Pref.	5½	5½	103xd	..	5 6 10
Ord.	4	4	65	+½	6 3 0
Canadian Marconi $1	Nil	4cts.	5/6	..	3 6 0
Globe Tel. & Tel.:					
Ord.	8½*	8½*	28/9	..	—
Pref.	6	6	28/9	..	4 3 6
Great Northern Tel. (£10)	20	20	14½	..	—
Inter. Tel. & Tel.	Nil	Nil	3	..	—
Marconi-Marine	7½	7½	27/6	+1/16	5 9 1
Oriental Tel. Ord.	11½*	16	71/3	..	4 9 10
Telephone Props.	6	6	11/3	..	10 13 4
Tele. Rentals (5/–)	10	10	9/–	..	5 11 3
Traction and Transport					
Anglo. Arg. Trams:					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc.	Nil	Nil	7½	..	—
Brit. Elec. Traction:					
Def. Ord.	45	45	875	–10	5 2 10
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	8*	8	42/6	..	3 15 4
Brazil Traction	$1	50c.	10½	–½	—
Calcutta Trams	8	5½	23/9	..	4 12 7
Cape Elec. Trams	5	5	19/–	..	5 5 3
Lancs Transport	10	10	42/6	..	4 14 1
Mexican Light:					
1st Bonds	5	5	60	+2	—
Rio 5% Bonds	5	5	94½	+2	5 5 10
Southern Rly.:					
5% Prefd.	5	5	60½	–1	8 5 4
5% Pref.	5	5	98½	..	5 1 7
T. Tilling	10	10	46/3	..	4 6 7
Tilling & B.A.	8*	7*	52/6	..	2 13 4
West Riding	10	10	39/–	..	5 2 7

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Oct. 21	Rise or Fall	Yield p.c.
Equipment and Manufacturing					
					£ s. d.
Aron Elec. Ord. ..	Nil	7½	22/–	..	6 16 4
Assoc. Elec.:					
Ord.	10	10	43/9	..	4 16 3
Pref.	8	8	36/3	..	4 8 5
Automatic Tel.& El.	12½	12½	48/9	+½	5 2 6
Babcock & Wilcox	11	11	45/–	–9d.	4 17 9
British Aluminium	12½	10	44/6	–6d.	4 10 0
British Insul. Ord..	20	20	91/3	..	4 7 9
British Thermostat (5/–)	18½	18½	13/9	..	6 14 6
British Vac. Cleaner (5/–)	12½	10	12/6	..	4 0 0
Brush Ord... ..	Nil	Nil	4/6	..	—
Callender's ..	15	15	72/6	..	4 2 9
Chloride Elec.Storage	15	15	70/–	+½	4 5 9
Consolidated Signal	17	17	75/–	..	4 10 10
Crabtree (10/–) ..	17½	17½	28/9	..	6 1 9
Crompton Parkinson Ord. (5/–) ..	30	20	20/–	..	5 0 0
E. K. Cole (5/–) ..	10	Nil	7/6	+6d.	—
E.M.I. (10/–) ..	Nil	6	12/6	..	4 16 0
Electric Construction	10½	10	32/6	..	6 3 0
Enfield Cable Ord.	16½	12½	53/9	..	4 13 0
Elecl. Switchgear (10/–)	16	10	20/–	..	5 0 0
English Electric ..	10	10	36/3	..	5 10 4
Ensign Lamps (5/–)	25	25	16/3	..	7 13 10
Ericsson Tel. (5/–)..	25*	22*	40/–xd	..	2 13 4
Ever Ready (5/–) ..	40	40	29/–	..	6 18 0
Falk Stadelmann ..	7	7½	17/6	..	8 11 6
Ferranti Pref. ..	7	7	26/3	..	5 6 10
G.E.C.:					
Pref.	6½	6½	32/6	..	4 0 0
Ord.	20	17½	77/6	..	4 10 2
Greenwood & Batley	15	13	25/–	+1/9	10 8 0
Hall Telephone (10/–)	15	10	15/–	..	6 13 4
Henley's (5/–) ..	20	20	22/6	+½	4 9 1
4½% Pref. ..	4½	4½	21/3	..	4 4 8
Hopkinsons ..	15	15	45/–xd	..	6 13 4
India-Rubber Pref.	5½	5½	21/3	..	5 3 6
Intl. Combustion ..	32½	30	105/–	..	5 14 3
J. Lucas	15	15	60/–	..	5 0 0
Johnson & Phillips	15	15	53/3	..	5 12 9
Lancashire Dynamo	20	20	62/6	..	6 8 0
Laurence, Scott (5/–)	15	15	11/–	..	6 16 4
London Elec. Wire	7½	7½	25/–	..	6 0 0
Mather & Platt ..	13½	10	42/6	..	4 14 1
Metropolitan Elec. Cable Pref. ..	5½	5½	21/3	..	5 3 6
Murex	20	20	85/–	..	4 14 1
Pye Deferred (5/–)..	25	25	13/9	..	9 1 10
Revo (10/–) ..	5	20	25/–	+½	8 0 0
Reyrolle	12½	12½	56/3	..	4 9 0
Siemens Ord. ..	7½	7½	25/–	..	6 0 0
Strand Elec. (5/–)..	4	2	3/–	..	3 6 8
S. Smith (4/–) ..	37½	50	7/–	..	7 2 10
Switchgear & Cowans (5/–) ..	10	15	10/–	..	7 10 0
Tel. Condenser (10/–)	Nil	5	11/3	..	4 9 0
T.C. & M.	10	10	41/3	..	4 17 0
Telephone Mfg. (5/–)	9	9	8/3	..	5 9 1
Tube Investments..	23¾	23¾	92/6	..	5 2 8
Vactric (5/–) ..	4	Nil	3/6	..	—
Vickers (10/–) ..	10	10	16/6	–3d.	6 1 3
Ward & Goldstone (5/–)	20	20	17/6	+1/–	5 14 3
Westinghouse Brake	17½	10	47/6	..	4 4 4
Walsall Conduits(4/–)	55	55	31/3	..	7 0 9
West, Allen (5/–) ..	7½	7½	5/–	..	7 10 0

* Dividends are paid free of Income Tax.

Stocks and Shares (*Concluded from page* 451)

on account of the high return which the shares afford at the present price of 25s. 6d., at which 3,500 are on offer. On the last-paid dividend of 20 per cent., the yield comes to £7 16s. 10d. Crabtree 10s. shares at 28s. 6d., at which 2,000 can be obtained, give £6 2s. 10d. on the 17½ per cent. dividend.

Redemption Terms

It is perhaps hardly necessary to mention that the buyer of debenture stocks should make a point of ascertaining the terms of redemption attaching to the security. Many people have experienced shocks in finding their stock redeemed at a price well below that which they have paid for it. By way of illustration, the 5 per cent. first mortgage debenture stock of Thomas Tilling may be cited. There is, at the time of writing, £2,000 of this stock on offer in the market at 105, with sufficient security at the back of it to make the stock an absolutely gilt-edged investment.

At the price mentioned, the yield is 4¾ per cent. on the money. But the company has the right to pay off the stock any time after 1943 at 100; and, unless monetary conditions change a good deal, it is no more than prudent to assume that Tillings may redeem this debenture early in 1944. The buyer of to-day who gives 105, might find, therefore, his stock paid off at 100 in 1944. If so, it would reduce the redemption yield on his money to £2 8s. 9d. per cent., about half the amount of the running yield of 4¾ per cent.

Crompton Parkinson

Crompton Parkinsons at 20s. are unaffected by the announcement that the company proposes to buy all the issued shares of the Young Accumulator Co. Negotiations to this end have been in course of progress for some time past, and the matter has materialised in an offer by Crompton Parkinson of 11d. in cash, plus 1s. 4d. in shares of Crompton Parkinson, making 2s. 3d. per florin share. The shares of the Young Accumulator Co. had been changing hands prior to announcement of the proposals at 2s. and a little under. The offer, on the face of it, appears to be a fair one, and its acceptance by the necessary proportion of shareholders to make it effective, may be expected.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1938

16258. "Means for varying the permeability of magnetic conductors for induction coils, transformers, and the like." H. Muller. December 22nd, 1939. (Convention date not granted.) (539773.)

1939

32172. "Electric motor control system involving a tape-control arrangement." D. F. Newman. December 24th, 1938. (539778.)

32609. "Contact arrangements for electric circuit-breakers." General Electric Co., Ltd., and F. J. Keeley. December 20th, 1939. (539780.)

1940

289. "Road vehicle lighting." A. E. Stroud and H. Swinnerton. January 5th, 1940. (539742.)

1178. "Electric control systems for electric motors." G. Pate. January 19th, 1940. (539744.)

1928. "Metal cloths." Compagnie Générale d'Electricité. February 4th, 1939. (539854.)

2567. "Starting devices for internal-combustion engines." Aktiebolaget Bolinder-Munktell. February 13th, 1939. (539815.)

2980. "Electric calculator equipment." Standard Telephones & Cables, Ltd. (W. Hatton, L. B. Haigh and L. Kozma). February 16th, 1940. (539745.)

3007. "Electric projection lamps." M. C. Harley. February 16th, 1940. (539783.)

3372. "High-voltage electrostatic apparatus." Research Corporation. February 24th, 1939. (539790.)

3392. "Direction indicating instruments." Scophony, Ltd., G. Wikkenhauser and P. L. F. Jones. February 23rd, 1940. (539817.)

3491. "Electron-discharge valve amplifiers." A. H. Cooper. February 24th, 1940. (539859.)

5040. "Fading compensation in radio receivers." Marconi's Wireless Telegraph Co., Ltd. March 18th, 1939. (539793.)

5068. "Glass fibre products." British Thomson-Houston Co., Ltd. March 21st, 1939. (539797.)

5103. "Power transmission mechanism such as for driving time-controlled apparatus." B. G. Horstmann, and Horstmann Gear Co., Ltd. March 19th, 1940. (539798.)

5184. "Three-speed gear." Lancashire Dynamo & Crypto, Ltd., and E. P. Wilson. March 20th, 1940. (539800.)

5267. "Thermionic valve amplifiers." Standard Telephones & Cables, Ltd., and A. J. Maddock. March 21st, 1940. (539802.)

5268. "Neon or like gas or vapour filled electron-discharge devices." Standard Telephones & Cables, Ltd., and R. R. Back. March 21st, 1940. (539803.)

5304. "Gaseous electric insulating media." A. Reyrolle & Co., Ltd., and P. D. Ritchie. March 21st, 1940. (539749.)

5349. "Electrical signalling systems." Automatic Telephone & Electric Co., Ltd., R. Taylor and G. T. Baker. March 23rd, 1940. (539823.)

5414. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd. March 23rd, 1939. (Addition to 521818.) (539897.)

5471. "Electronic control system." A. H. Stevens (Bristol Co.). March 26th, 1940. (539864.)

5920. "Bipolar electrolysers." Maschinenfabrik Oerlikon. February 17th, 1940. (539865.)

6013. "Means for saving life." General Electric Co., Ltd., G. Ellis and C. W. Saunders. April 3rd, 1940. (539751.)

6058. "Calibrating scales suitable for use in radio receivers." Marconi's Wireless Telegraph Co., Ltd., and H. C. Norwood. April 3rd, 1940. (539812.)

6211. "Means for generating electric oscillations." Baldwin Co. April 11th, 1939. (539752.)

6570. "Dynamo-electric generator handlamps." C. Bernhardt. April 11th, 1940. (539869.)

6981. "Electrically operated device for liquid level regulation." Londex, Ltd., and W. Stern. April 18th, 1940. (539827.)

7235. "Luminescent-screen apparatus for recording and observing oscillations such as cardiac pulsations." G. Asher and F. E. Hoecker. April 22nd, 1940. (539870.)

7661. "Multiplex telegraph systems." Marconi's Wireless Telegraph Co., Ltd. April 29th, 1939. (539871.)

8676. "Arc-suppression arrangements, applicable more particularly to transmission lines." General Electric Co., Ltd., and J. G. Clemetson. May 15th, 1940. (539902.)

8792. "Apparatus for measuring impedance." C. G. Mayo and H. D. M. Ellis. May 16th, 1940. (539903.)

9108. "Method and apparatus for estimating electric current in conductors." E. W. Marchant. May 23rd, 1940. (539904.)

9347. "Mounting for telegraphone pole-pieces." Electrical Research Products, Inc. July 13th, 1939. (539833.)

9808. "Reflectors of electric lamp fittings." Veritys, Ltd., and J. W. Forth. June 5th, 1940. (539876.)

10757. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. June 24th, 1939. (539835.)

10789. "Automatic regulating systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. June 24th, 1939. (539837.)

11501. "Fault indicating means for electrical control and protective circuits." R. H. Coates, and Metropolitan-Vickers Electrical Co., Ltd. July 10th, 1940. (539839.)

11677. "Electric motor control systems." British Thomson-Houston Co., Ltd. July 13th, 1939. (539840.)

12000. "Method and means for transposing electrical transmission lines." Standard Telephones & Cables, Ltd. October 20th, 1939. (539842.)

12371. "Two-way transmission systems." Associated Electric Laboratories, Inc. August 14th, 1939. (539763.)

12604. "Control systems for electrically driven vehicles." British Thomson-Houston Co., Ltd. August 4th, 1939. (539766.)

12889. "Contact breaker levers for ignition apparatus." British Thomson-Houston Co., Ltd., and R. T. Coe. August 12th, 1940. (539843.)

13155. "Electric fires or heaters." D. H. Davies and F. Kirby. August 17th, 1940. (539771.)

13850. "Electric contact combinations." Mallory Metallurgical Products, Ltd. February 20th, 1940. (539845.)

13852. "Electric make-and-break contacts." Mallory Metallurgical Products, Ltd. February 3rd, 1940. (539846.)

14226. "Time - delay electric switches." British Thomson-Houston Co., Ltd. September 16th, 1939. (539881.)

14227. "Bases for electric lamps and similar devices." British Thomson-Houston Co., Ltd. September 16th, 1939. (539916.)

14242. "Apparatus for electroplating." Mond Nickel Co., Ltd. September 16th, 1939. (539882.)

14699. "Excess voltage protective tubes" Westinghouse Electric International Co. September 30th, 1939. (539885.)

15595. "Mechanically operated contactor switches." H. Morris, Ltd., and W. Freeman. October 23rd, 1940. (539889.)

15780. "Electric valve converting apparatus." British Thomson-Houston Co., Ltd. October 26th, 1939. (539890.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—SYDNEY COUNTY COUNCIL.—November 27th. Two 30,000-kVA transformers for Bunnerong. Specification 544.

Belfast.—October 27th. City Council. Electrical installation and air conditioning at Upper Newtownards Report Centre. Particulars from City Surveyor, City Hall.

Birmingham.—November 7th. Electric Supply Committee. Compressed air pipework, valves, fittings, etc. Specifications from Mr. F. Forrest, chief engineer, 14, Dale End, Birmingham.

Portsmouth.—October 27th. Electricity Department. Six 400-kVA transformers. Forms of tender from Contracts Section, City Treasurer's Department, Northern Secondary School.

Sleaford.—November 17th. Electricity Department. 150-kVA, three-phase transformer. (See this issue.)

South Africa.—POST OFFICE.—December 4th. Equipment for radio-telephone link between Maseru and Mokhotlong.

Orders Placed

Birmingham.—Electricity Committee. Tenders accepted from May 17th to September 17th: Two electric capstans and two fairleads for No. 1 coal handling plant at Hams Hall "B" power station. —Stothert & Pitt, Ltd. Feeder reactor at Princes generating station.—G.E.C. Supplemental contract for supply delivery and installation of transformer cables at Hams Hall "A" and Princes power stations and Wood Lane substation, and supplemental contract for the supply and delivery of earthenware conduit for electric cables for twelve months from January 1st, 1941. —Callender's. Storage batteries and charging equipment at Hams Hall "B" power station.—Tudor Accumulator Co.

Warrington.—Electricity Committee. Accepted. Fire protection equipment for cable tunnels.—Mather & Platt, Ltd. Cables for twelve months.—British Insulated Cables, Ltd.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barking.—Block of offices; William Warne & Co., Ltd.

Bedford.—Depots, Newnham Avenue and Preston Road (£5,400); W. T. Glass & Son.

Birmingham.—Extensions; Batchelor, Robinson & Co., Ltd.

Factory (£3,500); Stern & Bell, Ltd.

Bolton.—Flats, 135, Radcliffe Road; F. Haslam.

Remand home, Townley's House (£1,000); borough engineer.

Cambridgeshire.—Additional office accommodation, Cambridge (£2,000), for Standing Joint Committee; county architect, Shire Hall, Cambridge.

Cheetham.—Works; A. Isaacs, architect, 136, Middleton Road, Manchester 8.

Chester.—Works additions; Chester Engineering Co., Ltd.

Lodge and office, Reliance Works; Williams, Ltd.

Factory additions; W. T. Davies & Sons, Ltd.

Chesterfield.—Canteens for Derbyshire Miners' Association, 98, Saltergate, Chesterfield.

Chichester.—Adaptation of Council House as British Restaurant; town clerk, 61, North Street.

Coventry.—Houses and garages; D. E. E. Gibson, 1A, Warwick Row, Coventry.

Dorking.—Equipping community centre at Albemarle Billiards Saloon (£1,400); clerk, Council Offices, Pippbrook, Dorking.

Easington (Co. Durham).—More British Restaurants; C. Clarke, surveyor, R.D.C. offices, Easington, co. Durham.

Glasgow.—Riding school for mounted police (£10,000); city engineer.

Hendon.—Paint shop extension for Spurling Motor Bodies, Ltd.; Cottrell & Ship, Ltd., builders, 40, Coleridge Road, N.8.

Additions, Hendon Way; Fraser & Turnbull.

Leatherhead.—British Restaurants at Bookham and Village Hall, Fetcham, for U.D.C.; L. Davies, surveyor, Urban Council Offices, Leatherhead.

Leeds.—British Restaurant in Town Hall Crypt; W. S. Cameron, city engineer, Civic House.

London.—GREENWICH.—Scheme for day nurseries; C. H. Jennings, borough engineer, Town Hall, S.E.10.

Malvern.—Remand home; H. Rowe & Son, county architects, 38, Foregate Street, Worcester.

Manchester.—Motor body building works; Star Motor Bodies, Ltd., 56, Liverpool Street, Salford.

Mexborough. — Extensions to Montagu Hospital; F. H. Harrop, chairman, Board of Management.

Newcastle (Staffs).—Houses, Fenton, Hanley and Longport; G. H. Wignall, Ltd., builders, Court Lane Gardens, Newcastle-under-Lyme.

Oldham.—Cleansing station and hospital kitchens; G. E. Hardy, borough engineer, 75, Union Street, Oldham.

Oxford.—Additions and alterations, Bridge House Hotel, Botley Road; C. Kitchen.
Laboratory at Eye Hospital, Walton Street; Lanchester, Lodge and Davis.

Pwllheli.—Extensions to public abattoirs; C. Roberts, borough surveyor, Town Hall.

Romford.—Staff accommodation, Oldchurch Hospital (£4,150); Hoad & Sons, Ltd.

Rotherham.—Additions, Domini Lane; Rotherham Co-operative Society, Ltd., Main Street.
Office, Wortley Road; R. Jenkins & Co., Ltd.

Rutland.—School canteens at Belton, Empingham, Ketton, Market Overton, South Luffenham, and Whissendine; county surveyor, Catmos House, Oakham.

Salford.—Installation of electrically operated paper baling press at cleansing depot; H. S. Whitehead, director of public cleansing, 10, Encombe Place, Salford, 3.

Sedgefield (Co. Durham).—British Restaurants; J. Tarren, surveyor, R.D.C. Offices, Sedgefield, Co. Durham.

Stalybridge.—Office extensions; R. J. Coley & Son (Hounslow), Ltd.

Stockton-on-Tees.—Office extensions for R. Robinson (Transporters), Ltd.; G. P. Stainsby, architect, 25, High Street, Stockton.
Canteen for Head, Wrightson & Co., Ltd.
Ambulance station for Ashmore, Benson Pease & Co.; G. P. Stainsby, architect.
Four more British Restaurants; A. Knolles, borough engineer, Town Hall, Stockton-on-Tees.

Stretford.—General stores, Trafford Wharf Road; Manchester Dry Docks Co., Ltd.

Swansea.—Office and stores, Mumbles Road; James Harries.
School shelters (£8,500); borough architect.

Wakefield.—Extensions, Marine workshop; A. & F. Mosley, Ltd., Leeds.

Warrington.—Canteen, Bewsey Road; Lancashire Steel Corporation.
Shed and kitchen, John Street; Winwick Street Tanning Co., Ltd.
Mess room, etc.; J. Crosfield & Sons, Ltd.
British Restaurant, Tower Buildings; Wright Bros., builders, Victoria Road, Stockton Heath.

Wellington (Salop).—Pumping station, for R.D.C.; J. E. Morris, clerk, Council Chambers, Tan Bank, Wellington, Salop.

West Penwith.—British Restaurants at Marazion and Hayle; clerk, Rural District Council Offices, 38, Chapel Street, Penzance.

Whalton (Northumberland).—Land workers' hostel; R. Carse & Sons, contractors, Oldgate, Morpeth.

Workington.—Fire station; borough engineer.

York.—Equipment, new general hospital; medical officer of health.

TRADE MARK APPLICATIONS

THE following applications have been made for British trade marks. Objections may be entered within a month from the dates mentioned:—

October 8th

SANWEST. No. 614,259, Class 9. Electrical integrating and precision meters, photometers, time switches (electrical), instrument type electric relays, dry plate electric current rectifiers, instrument type transformers, prepayment electricity meters and parts thereof.—Sangamo Weston, Ltd., Great Cambridge Road, Enfield.

NORPRENE. No. 615,892, Class 17. India-rubber, balata, gutta percha, artificial indiarubber, insulating bands, electric insulating material, electric insulation parts, electric insulators, insulating gloves, etc.—North British Rubber Co., Ltd., Castle Mills, Fountainbridge, Edinburgh.

OHMALINE. No. 615,963, Class 17. Insulating varnish.—Griffiths Bros. & Co., London, Ltd., 29, Macks Road, Bermondsey, London, S.E.16.

October 15th

BRECO. 615,483, Class 9. Electrical transformers, and alternating current arc welding apparatus incorporating such transformers.—Brentford Transformers, Ltd., Breco Works, 234A, High Street, Brentford, Middlesex.

KALEFLEX. 615,737, Class 9. Electric cables and electric wires, but not including rubber insulated flexible electric cables. KALEFLEX. 615,738, Class 17. Electric insulating materials, electric insulators, electric insulating tubing and sleeving and parts of electrical apparatus made of insulating material.—Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.4.

ASEA. 613,672, Class 11. Installations for lighting, heating, steam generating, cooking and refrigerating, drying and ventilating, all being electrically operated.—Asea Electric, Ltd., Fulbourne Road, Walthamstow, London, E.17.

MICOFLEX. 615,738, Class 17. Insulating sleeving, composed principally of synthetic resin, for electrical conductors.—The Micanite & Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, London, E.17.